PRELIMINARY GEOTECHNICAL EVALUATION

FOR

PROPOSED RESIDENTIAL DEVELOPMENT
TRACT NO. 17439, PASEOS PROJECT
CITY OF LAKE FOREST, ORANGE COUNTY, CALIFORNIA

PREPARED FOR

TRUMARK COMPANIES
9911 IRVINE CENTER DRIVE, SUITE 150
IRVINE, CALIFORNIA 92618

PREPARED BY

GEOTEK, INC.
710 EAST PARKRIDGE AVENUE, SUITE 105
CORONA, CALIFORNIA 92879

PROJECT NO. 0750-CR3 APRIL 4, 2012

GEOTEK

April 4, 2012
Project No. 0750-CR3

Trumark Companies
9911 Irvine Center Drive, Suite 150
Irvine, California 92618

Attention: Mr. James O'Malley

Subject: Preliminary Geotechnical Evaluation
Proposed Residential Development
Tract No. 17439, Paseos Project
City of Lake Forest, Orange County, California

Dear Mr. O'Malley:

We are pleased to provide herein the results of our preliminary geotechnical evaluation for the subject property located in the City of Lake Forest, Orange County, California. This report presents the results of our evaluation, discussion of our findings, and provides geotechnical recommendations for earthwork, foundation design and construction. In our opinion, site development appears feasible from a geotechnical viewpoint provided that the recommendations included herein are incorporated into the design and construction phases of site development.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

REGISTERED GEOLOGIST EDWARD H. LaMONT No. 1892 Exp. 7-31-12 Certified Engineering Geologist STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER RONALD A. REED No. 2524 Exp. 6-30-13 GEOTECHNICAL STATE OF CALIFORNIA

Ronald A. Reed

Edward H. LaMont
CEG 1892, Exp. 07/31/12
Principal Geologist

Ronald A. Reed
GE 2524, Exp. 06/30/13
Senior Project Engineer

Distribution: (5) Addressee

G:\Projects\0701 to 0750\0750CR3 Trumark Homes Foothill Ranch\Geotechnical Evaluation\0750CR3 Geotechnial Evaluation Report.doc

TABLE OF CONTENTS

TABLE OF CONTENTS

1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the general geotechnical conditions on the site. Services provided for this study included the following:

- Research and review of available geologic data and general information pertinent to the site,
- Site exploration consisting of a site reconnaissance and review completed by an engineering geologist from this firm,
- Review and evaluation of site seismicity, and
- Compilation of this geotechnical report which presents our findings, conclusions, and recommendations for site development.

The intent of this report is to aid in the design and construction of the proposed development. Implementation of the recommendations presented in Section 5 of this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical recommendations contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The subject site is located at 70 Auto Center Drive, in the City of Lake Forest, Orange County, California (see Figure 1). The site is the previous location of an automobile dealership that is no longer in business. Buildings, parking areas and landscaping associated with the former dealership are still present. The site is irregularly shaped and overall current site topography can be described as relatively flat, with surface drainage directed to the south via sheetflow. Prior to site development, the site was situated on a relatively small ridgeline that trended northeast-southwest, and descended to the southwest (see Figure 2).

Based on review of a *Precise Grading Report* by Pacific Soils Engineering, Inc. (PSE, 2002), the subject site was initially rough graded in several phases over a period of time between September of 1995 and November of 1998. Subsequent precise grading of the site is reported in PSE's report dated February 12, 2002.

Currently, the northeastern portions of the site are roughly 10 feet higher than the southern. Small slopes along the western edge of the property are also present which descend down at gradients of 2:1 (h:v) or less, to Towne Centre Drive and Auto Center Drive respectively along these perimeter site areas (see Figure 3 and *Conceptual Grading Plan*, Plate 1). These existing slopes are on the order of up to roughly five (5) feet in height. A block wall is also located atop portions of this slope, which may locally be retaining some material.

2.2 PROPOSED DEVELOPMENT

It is our understanding that the site is proposed for one- to two- story, single-family attached residences with associated street improvements. It is anticipated that cuts and fills of up to three (3±) feet will be required to achieve finish grades. A *Conceptual Grading Plan*, prepared by RBF Consulting (project civil engineer), is included as Plate 1 at the back of this report. More finalized grading plans should be reviewed by GeoTek as they become available.

If site development differs from the assumptions made herein, the recommendations included in this report should be subject to further review and evaluation. As the project progresses and more detailed plans become available, the plans should be provided to GeoTek for review and comment.

3. EXISTNG REPORTED FIELD CONDITIONS

3.1 FIELD CONDITIONS

A site reconnaissance was recently completed by GeoTek to assess existing site conditions. The site reconnaissance was completed after review of the referenced geotechnical reports by PSE for the subject property (see Section 7.0). The reports by PSE document existing site geotechnical conditions. A copy of the *Precise Grading Report* prepared by PSE (2002) is included in Appendix A at the back of this report.

3.2 LABORATORY TESTING

Laboratory testing reported by PSE (2002) indicates that site fill materials reported to underlie the existing site buildings are in the "very low" expansion potential range. In addition, reported chemical analyses indicated that sulfate resistant concrete was not required. Additional testing of as graded soils will need to be completed subsequent to the currently proposed earthwork construction to confirm site conditions prior to proposed development.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The subject property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. Basically, it extends roughly 975 miles from the north and northeasterly adjacent the Transverse Ranges geomorphic province to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Three major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zones trend northwest-southeast and are found in the near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

4.2 GENERAL SOIL CONDITIONS

A brief description of the earth materials reported to underlie the site is presented in the following section. Based on our site reconnaissance, review of published geologic maps and the geotechnical reports by PSE (2002 and 2003), the site is underlain by engineered fill and sedimentary bedrock materials.

4.2.1 Engineered Fill

Engineered fill soils are reported to underlie a majority of the site, with the exception of the northeastern one-third (±) of the property (PSE, 2002). Although depths of the reported fill are not indicated in the referenced reports by PSE, a maximum depth of fill on the order of up to 20 feet is believed to exist toward the southern corner of the site, based on review of a pre-development topographic map of the area (see Figure 2). The existing building areas on the property are reported to have been over-excavated to a minimum depth of five (5) feet below existing finish grade elevations (PSE, 2002).

According to PSE, the fill materials were are predominantly comprised of silty sand. Based on the results of the laboratory testing reported by PSE (2002), the onsite fill materials have a very low expansion potential ($0 \leq EI \leq 21$).

4.2.2 Bedrock

Tertiary age sedimentary bedrock materials belonging to the Oso Member of the Capistrano Formation are reported to underlie the site as a whole, and to directly underlie the existing parking lot areas toward the northeastern portions of the site (PSE, 2002). This bedrock material is reported to consist of massive silty sandstone.

4.3 SURFACE WATER AND GROUNDWATER

4.3.1 Surface Water

If encountered during the earthwork construction, surface water on this site is the result of precipitation or possibly some minor surface run-off from immediately surrounding sites. Overall site area drainage is mostly in a southerly direction, with local variations. Provisions for surface drainage will need to be accounted for by the project civil engineer.

4.3.2 Groundwater

No natural groundwater condition is known to be present which would impact site improvements. Groundwater was not reported to have been encountered at the site in the referenced reports by PSE. Groundwater or localized seepage can occur due to variations in rainfall, irrigation practices, and other factors not evident at the time of this investigation.

4.4 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone or a Special Studies Zone.

4.4.1 Seismic Design Parameters

The site is located at approximately 33.6751 Latitude and -117.6612 Longitude. Site spectral accelerations (S_s and S_1), for 0.2 and 1.0 second periods for a Class "D" site, were determined from the USGS Website, Earthquake Hazards Program, Interpolated Probabilistic Ground Motion for the Conterminous 48 States by Latitude/Longitude, 2009 Data. The results are presented in the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_S	1.396g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.500g
Site Coefficient for Site Class "D", F_a	1.0
Site Coefficient for Site Class "D", F_v	1.5
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.396g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.750g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	0.930g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.500g

4.5 LIQUEFACTION/SEISMIC SETTLEMENT

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, consolidation and settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates.

The factors known to influence liquefaction potential include soil type and grain size, relative density, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are susceptible to liquefaction are loose, saturated granular soils having low fines content under low confining pressures.

The liquefaction potential on this site is considered negligible due the relatively dense nature of the underlying materials and lack of a shallow groundwater table. Seismic settlement potential is also considered low due to the dense nature of underlying materials.

4.6 OTHER SEISMIC HAZARDS

Evidence of ancient landslides or slope instabilities at this site was not observed during our investigation. Thus, the potential for landslides is considered negligible. In addition, no State of California designated Seismic Hazard Zones are identified to underlie the subject property (CDMG, 2008).

The potential for secondary seismic hazards such as seiche and tsunami are considered to be remote due to site elevation and distance from an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The proposed development of the site appears feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into the design and construction phases of development.

5.2 EARTHWORK CONSIDERATIONS

5.2.1 General

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the City of Lake Forest, the 2010 California Building Code (CBC), and recommendations contained in this report. The Grading Guidelines included in Appendix B outline general procedures and do not anticipate all site specific situations. In the event of conflict, the recommendations presented in the text of this report should supersede those contained in Appendix B.

5.2.2 Site Clearing and Preparation

Site preparation should start with demolition of existing improvements, removal of deleterious materials and vegetation. These materials should be disposed of properly off site.

Existing utilities and trench backfill that may be encountered should be removed to the property limits. Such improvements should be properly abandoned at the property limits.

5.2.3 Engineered Fill

The onsite materials are considered suitable for reuse as engineered fill provided they are free from vegetation, roots, and rock/concrete or hard lumps greater than six (6) inches in maximum dimension. The earthwork contractor should have the excavated materials that are proposed for use as engineered fill at this project approved by the soils engineer prior to placement.

Concrete generated from the demolition existing site improvements may be incorporated into site fills provided the following guidelines are implemented: 1) concrete should be free of rebar or other deleterious materials and should be broken down to a maximum dimension of six (6) inches; 2) concrete should not be placed within three (3) feet of finish grade in the building pad areas or within one (1) foot of subgrade elevations in the street/drive areas; 3) concrete should be distributed in the fill and should not be "nested" or placed in concentrated pockets.

Engineered fill materials should be moisture conditioned to at or above optimum moisture content and compacted in horizontal lifts not exceeding 8" in loose thickness to a minimum relative compaction of 90% as determined in accordance with laboratory test procedure ASTM D 1557.

If fill is being placed on slopes steeper than 5:1, the fill should be properly benched into the existing slopes and a sufficient size keyway shall be constructed in accordance with the recommendations of the soils engineer.

5.2.4 Remedial Grading

Prior to foundation construction or placement of fill materials, the upper three (3) feet of materials as measured from existing grades, should be removed and recompacted beneath all settlement sensitive structures and street/drive areas. The lateral extent of removal beyond the outside edge of all settlement sensitive structures/foundations should be equivalent to that vertically removed. Depending on actual field conditions encountered during grading, locally deeper and/or shallower areas of removal may be necessary.

The cut portion(s) of any transition building pad areas should be overexcavated a minimum of three (3) feet below finish pad grade or a minimum of two (2) feet below the bottom of the deepest proposed footing, whichever is deeper. Overexcavations should extend a minimum of five (5) feet outside the proposed building envelope(s).

The intent of the recommended overexcavation is to support the improvements on engineered fill with relatively uniform engineering characteristics and decrease the potential for future differential settlement.

Streets in areas of design cut should be overexcavated a minimum of one (1) foot below subgrade elevation or a minimum of three (3) feet below existing grade, whichever is deeper.

As a minimum, removals or overexcavations should extend beyond the depth of the existing, near surface foundation elements. If it is discovered during site grading/demolition that portions of the existing improvements are supported on deep foundation elements (i.e. caisson, piles, etc.), then additional recommendations will be required, and this office should be contacted.

The bottom of all removals should be scarified to a minimum depth of six (6) inches, brought to at or above optimum moisture content, and then compacted to minimum project standards prior to fill placement. The remedial excavation bottoms of should be observed by a GeoTek representative prior to scarification. The resultant voids from remedial grading/overexcavation should be filled with materials placed in accordance with Section 5.2.3 Engineered Fill of this report.

5.2.5 Excavation Characteristics

Excavations in the onsite materials can be generally accomplished with heavy-duty earthmoving or excavating equipment in good operating condition.

5.2.6 Shrinkage and Bulking

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage and subsidence are primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, a shrinkage factor of from 0 to 10 percent may be considered for the materials requiring removal and recompaction.

Subsidence on the order of up to approximately ½-inch may occur. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of site earthwork construction.

5.2.7 Trench Excavations and Backfill

Temporary excavations within the onsite materials should be stable at 1H:1V inclinations for short durations during construction, and where cuts do not exceed 10 feet in height. Temporary cuts to a maximum height of 4 feet can be excavated vertically.

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should be compacted to at least 90% relative compaction (as determined per ASTM D 1557). Under-slab trenches should also be compacted to project specifications. Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for road pavements should be compacted to at least 95 percent relative compaction. Onsite materials may not be suitable for use as bedding material, but should be suitable as backfill provided particles larger than 6± inches are removed.

Compaction should be achieved with a mechanical compaction device. Ponding or jetting of trench backfill is not recommended. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

Foundation design criteria for a conventional foundation system, in general conformance with the 2010 CBC, are presented herein. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Based on the results of this investigation, the expansion potential of the onsite soils near subgrade may be classified as "very low" ($0>EI\leq 20$) per ASTM D 4829. Additional laboratory testing should be performed at the completion of site grading to verify the expansion potential and plasticity index of the subgrade soils.

A summary of our foundation design recommendations are presented in Table 5.3.1 below:

TABLE 5.3.1 – MINIMUM DESIGN RECOMMENDATIONS

DESIGN PARAMETER	0<EI≤20 & PI<16
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	Supporting One Floor – 12 Supporting Two Floors – 18
Foundation Width (Inches)	Supporting One Floor – 12 Supporting Two Floors – 15
Minimum Slab Thickness (inches)	4 (actual)
Minimum Slab Reinforcing	No. 3 rebar 18" on-center, placed in middle third of slab
Minimum Footing Reinforcement	Two (2) No. 4 Reinforcing Bars, one (1) top and one (1) bottom
Effective Plasticity Index	12
Presaturation of Subgrade Soil (Percent of Optimum/Depth in Inches)	100%/12 inches

It should be noted that the above recommendations are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions. If it is desired to utilize post-tensioned foundations, then additional recommendations can be provided.

The following criteria for design of foundations should be implemented into design:

5.3.1.1 An allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design of continuous and perimeter footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep. This value may be increased by 250 pounds per square foot for each additional 12 inches in depth and 125 pounds per square foot for each additional 12 inches in width to a maximum value of 2,500 psf. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads).

5.3.1.2 Based on our experience in the area, structural foundations may be designed in accordance with 2010 CBC, and to withstand a total settlement of 1 inch and maximum differential settlement of one-half of the total settlement over a horizontal distance of 40 feet.

5.3.1.3 The passive earth pressure may be computed as an equivalent fluid having a density of 250 psf per foot of depth, to a maximum earth pressure of 2,500 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.30

may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

5.3.1.4 A grade beam, a minimum of 12 inches wide and 12 inches deep, should be utilized across large entrances. The base of the grade beam should be at the same elevation as the bottom of the adjoining footings.

5.3.1.5 A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these systems are provided in the 2010 California Green Building Standards Code (CALGreen) Section 4.505.2 and the 2010 CBC Section 1910.1. It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as the result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as a moisture/vapor retarders may also be more puncture resistant. It is GeoTek's opinion that a minimum 10 mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and atmospheric conditions. Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (.e. thickness, composition, strength, and permeance) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation.

5.3.1.6 We recommend that control joints be placed in two directions spaced the numeric equivalent of two times the thickness of the slab in inches changed to feet (e.g. a 4 inch slab would have control joints at 8 feet centers). These joints are a widely accepted means to control cracks and should be reviewed by the project structural engineer.

5.3.2 Miscellaneous Foundation Recommendations

5.3.2.1 To minimize moisture penetration beneath the slab on grade areas, utility trenches should be backfilled with engineered fill, lean concrete or concrete slurry where they intercept the perimeter footing or thickened slab edge.

5.3.2.2 Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.

5.3.2.3 Unsuitable soil removals along the property lines may likely be restricted due to adjacent improvements. Special considerations will be required for foundation elements in these areas. Such considerations may include deepening of foundations, reduced bearing capacity, or other measures. This potential issue should be further evaluated once site plans become available.

5.3.3 Foundation Set Backs

Where applicable, the following setbacks should apply to all foundations. Any improvements not conforming to these setbacks may be subject to lateral movements and/or differential settlements:

- The outside bottom edge of all footings should be set back a minimum of H/3 (where H is the slope height) from the face of any descending slope. The setback should be at least 7 feet and need not exceed 40 feet.
- The bottom of all footings for structures near retaining walls should be deepened so as to extend below a 1:1 projection upward from the bottom inside edge of the wall stem. This applies to the existing retaining walls along the perimeter, if they are to remain.
- The bottom of any existing foundations for structures should be deepened so as to extend below a 1:1 projection upward from the bottom of the nearest excavation.

5.3.4 Soil Corrosivity

Soil resistivity at this site was not reported in the referenced reports by PSE. Corrosion potential testing should be completed subsequent to the currently proposed precise grading. We recommend that a corrosion engineer be consulted to provide recommendations for proper protection of buried metal at this site.

5.3.5 Soil Sulfate Content

Sulfate content was reported by PSE (2002) to be in the "negligible" range. Based upon the reported test results, no special mix design is will required by Code to resist sulfate attack. Additional testing should be completed subsequent to rough grading in order to confirm these initial results.

5.4 RETAINING WALL DESIGN AND CONSTRUCTION

5.4.1 General Design Criteria

Recommendations presented herein may apply to typical masonry or concrete vertical retaining walls to a maximum height of 10 feet. Additional review and recommendations should be requested for higher walls.

Retaining wall foundations embedded a minimum of 18 inches into engineered fill or dense formational materials should be designed using an allowable bearing capacity of 2,000 psf. An increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads). The passive earth pressure may be computed as an equivalent fluid having a density of 250 psf per foot of depth, to a maximum earth pressure of 2,500 psf. A coefficient of friction between soil and concrete of 0.30 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

An equivalent fluid pressure approach may be used to compute the horizontal active pressure against the wall. The appropriate fluid unit weights are given in Table 5.4.1 below for specific slope gradients of retained materials.

Table 5.4.1 – Active Earth Pressures

Surface Slope of Retained Materials (H:V)	Equivalent Fluid Pressure (PCF) Select Backfill*
Level	35
2:1	50

*Select backfill should consist of imported sand other approved materials with an SE>30 and an EI≤20.

The above equivalent fluid weights do not include other superimposed loading conditions such as low expansive soil, vehicular traffic, structures, seismic conditions or adverse geologic conditions.

Additional lateral forces can be induced on retaining walls during an earthquake. For level backfill and a Site Class "D", the minimum earthquake-induced force (F_{eq}) should be $13H^2$ (lbs/linear foot of wall) for cantilever walls. This force can be assumed to act at a distance of 0.6H above the base of the wall, where "H" is the height of the retaining wall measured from the base of the footing (in feet).

5.4.2 Wall Backfill and Drainage

The onsite soils with "very low" expansion potential may be used for backfill provided they are free of materials greater than 3-inches in maximum dimension. Wall backfill should include a minimum one foot wide section of ¾ to 1-inch clean crushed rock (or approved equivalent). The rock should be placed immediately adjacent to the back of wall and extend up from the backdrain to within approximately 12 inches of finish grade. The upper 12 inches should consist of compacted onsite materials. If the walls are designed using the "select" backfill design parameters, then the "select" materials shall be placed within the active zone as defined by a 1:1 (H:V) projection from the back of the retaining wall footing up to the retained surface behind the wall. Presence of other materials might necessitate revision to the parameters provided and modification of wall designs.

The backfill materials should be placed in lifts no greater than 8-inches in thickness and compacted at 90% relative compaction in accordance with ASTM Test Method D 1557. Proper surface drainage needs to be provided and maintained. Water should not be allowed to pond behind retaining walls. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

Retaining walls should be provided with an adequate pipe and gravel back drain system to reduce the potential for hydrostatic pressures to develop. A 4-inch diameter perforated collector pipe (Schedule 40 PVC, or approved equivalent) in a minimum of one cubic foot per lineal foot of 3/8 to one inch clean crushed rock or equivalent, wrapped in filter fabric should be placed near the bottom of the backfill and be directed (via a solid outlet pipe) to an appropriate disposal area. Maximum horizontal spacing between drain outlets should be 100 feet.

Walls from 2 to 4 feet in height may be drained using localized gravel packs behind weep holes at 10 feet maximum spacing (e.g. approximately 1.5 cubic feet of gravel in a woven plastic bag). Weep holes should be provided or the head joints omitted in the first course of block extended above the ground surface. However, nuisance water may still collect in front of the wall.

Drain outlets should be maintained over the life of the project and should not be obstructed or plugged by adjacent improvements.

5.4.3 Restrained Retaining Walls

Any retaining wall that will be restrained prior to placing backfill or walls that have male or reentrant corners should be designed for at-rest soil conditions using an equivalent fluid pressure of 60 pcf (select backfill), plus any applicable surcharge loading. For areas having male or reentrant corners, the restrained wall design should extend a minimum distance equal to twice the height of the wall laterally from the corner, or as otherwise determined by the structural engineer.

5.4.4 Existing Retaining Walls

Since completed plans were not available at the time of our evaluation it is not known if the existing retaining walls along the southerly edges of the property limits will remain. If they are to remain, then no additional surcharge should be applied to the wall unless further evaluation is performed by a structural engineer. Also, if the walls are to remain, then the walls should be investigated for the presence of a backdrain and waterproofing. These items may need to be constructed if not already installed.

5.5 POST CONSTRUCTION CONSIDERATIONS

5.5.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff, and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. The soils should be maintained in a solid to semi-solid state as defined by the materials Atterberg Limits. Care should be taken when adding soil amendments to avoid excessive watering. Leaching as a method of soil preparation prior to planting is not recommended. An abatement program to control ground-burrowing rodents should be implemented and maintained. This is critical as burrowing rodents can decreased the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundation. This type of landscaping should be avoided. If used, then extreme care should be exercised with regard to the irrigation and drainage in these areas. Waterproofing of the foundation and/or subdrains may be warranted and advisable. We could discuss these issues, if desired, when plans are made available.

5.5.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground. Pad drainage should be directed toward approved area(s) and not be blocked by other improvements.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

5.6 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that site grading, specifications, retaining wall/shoring plans and foundation plans be reviewed by this office prior to construction to check for conformance with the recommendations of this report. Additional recommendations may be necessary based on these reviews. We also recommend that GeoTek representatives be present during site grading and foundation construction to check for proper implementation of the geotechnical recommendations. These representatives should perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of on-site and import materials for fill placement, and collect soil samples for laboratory testing when necessary.
- Observe the fill for uniformity during placement including utility trenches. Also, test the fill for field density and relative compaction.
- Observe and probe foundation materials to confirm suitability of bearing materials.

If requested, a construction observation and compaction report can be provided by GeoTek, which can comply with the requirements of the governmental agencies having jurisdiction over the project. We recommend that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

6. LIMITATIONS

The scope of our evaluation is limited to the area explored that is shown on the Boring Location Map (Figure 3). This evaluation does not and should in no way be construed to encompass any areas beyond the specific area of proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope is based on our understanding of the project and the client's needs, our proposal (Proposal No. P3-030212) dated March 15, 2012 and geotechnical engineering standards normally used on similar projects in this region.

The materials observed on the project site and described in the referenced reports appear to be representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during site construction. Site conditions may vary due to seasonal changes or other factors. GeoTek, Inc. assumes no responsibility or liability for work, testing or recommendations performed or provided by others.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty is expressed or implied. Standards of practice are subject to change with time.

7. SELECTED REFERENCES

California Code of Regulations, Title 24, 2010 "California Building Code," 3 volumes.

California Division of Mines and Geology (CDMG), 1977, "Geologic Map of California."

California Division of Mines and Geology (CDMG), 1998, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada: International Conference of Building Officials.

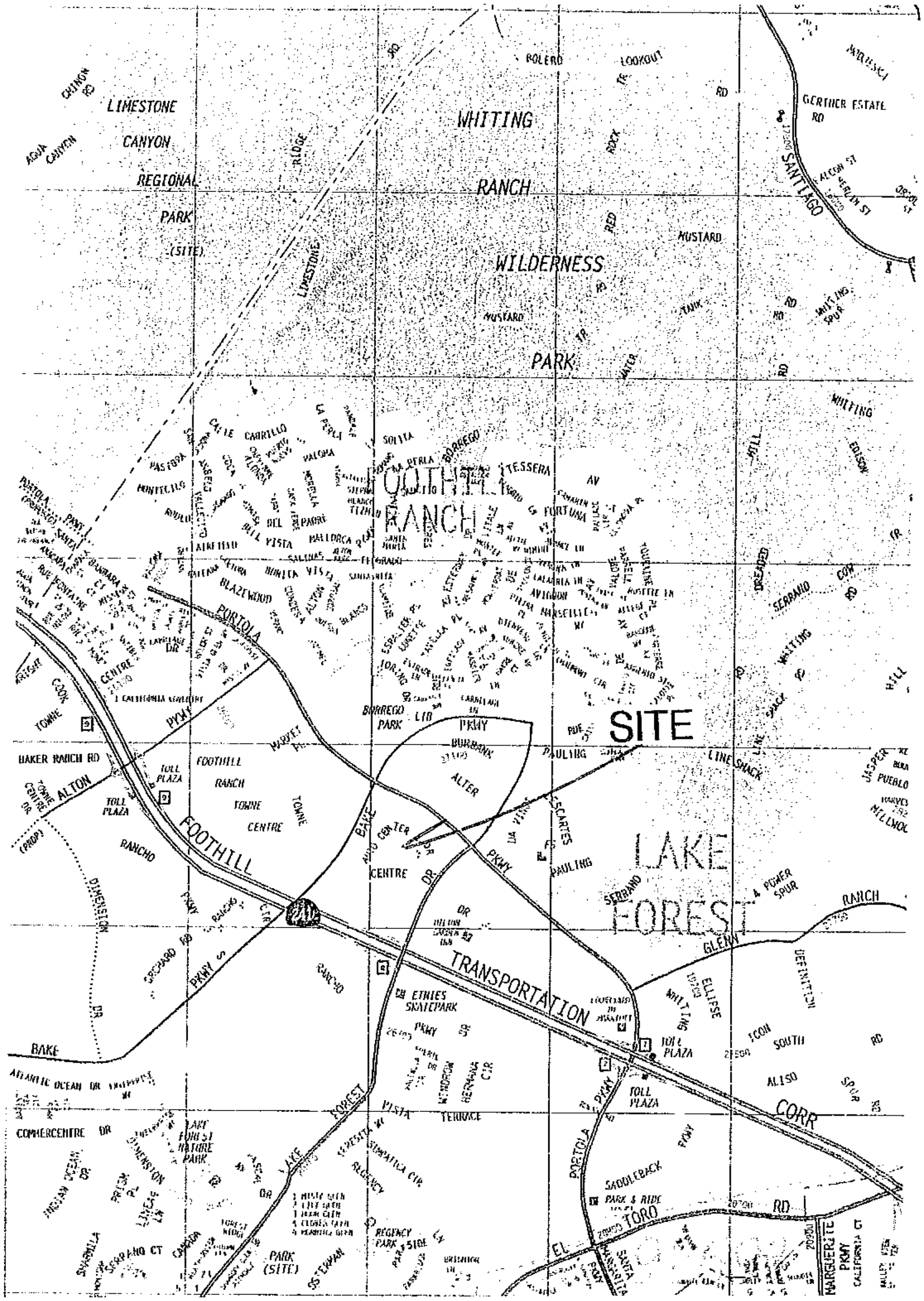
California Division of Mines and Geology (CDMG), 2008, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," Special Publication 117A.

GeoTek, Inc., In-house proprietary information.

Pacific Soils Engineering, Inc., 2003, "Final Onsite Report, MacPherson Chevrolet, 70 Auto Centre Drive, Foothill Ranch, City of Lake Forest, California," Work Order 50031212-M, dated February 26.

_____, 2002, "Precise Grading Report, MacPherson Chevrolet, 70 Auto Centre Drive, Foothill Ranch, City of Lake Forest," Work Order 500312-M, dated February 12.

Seismic Design Values for Buildings (http://earthquake.usgs.gov/research/hazmaps/design).



Trumark Companies
Proposed Residential Development
City of Lake Forest
Orange County, California

GeoTek Project No.: 0750-CR3

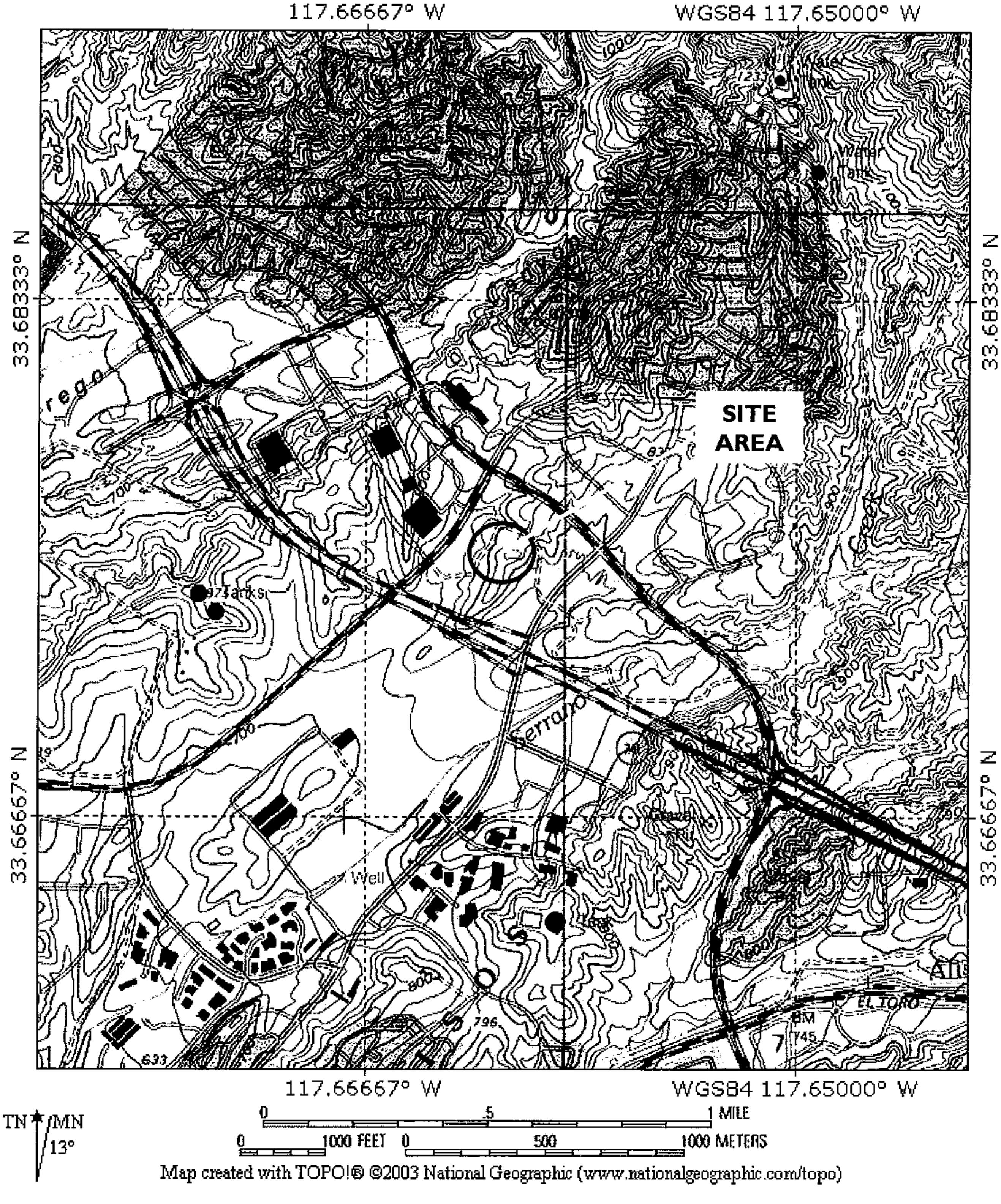
N

Modified from The Thomas Guide, Orange County, Scale: 1" = 2400'

Figure 1

Site Location Map

GEOTEK



Trumark Homes
The Village
City of Lake Forest
Orange County, California

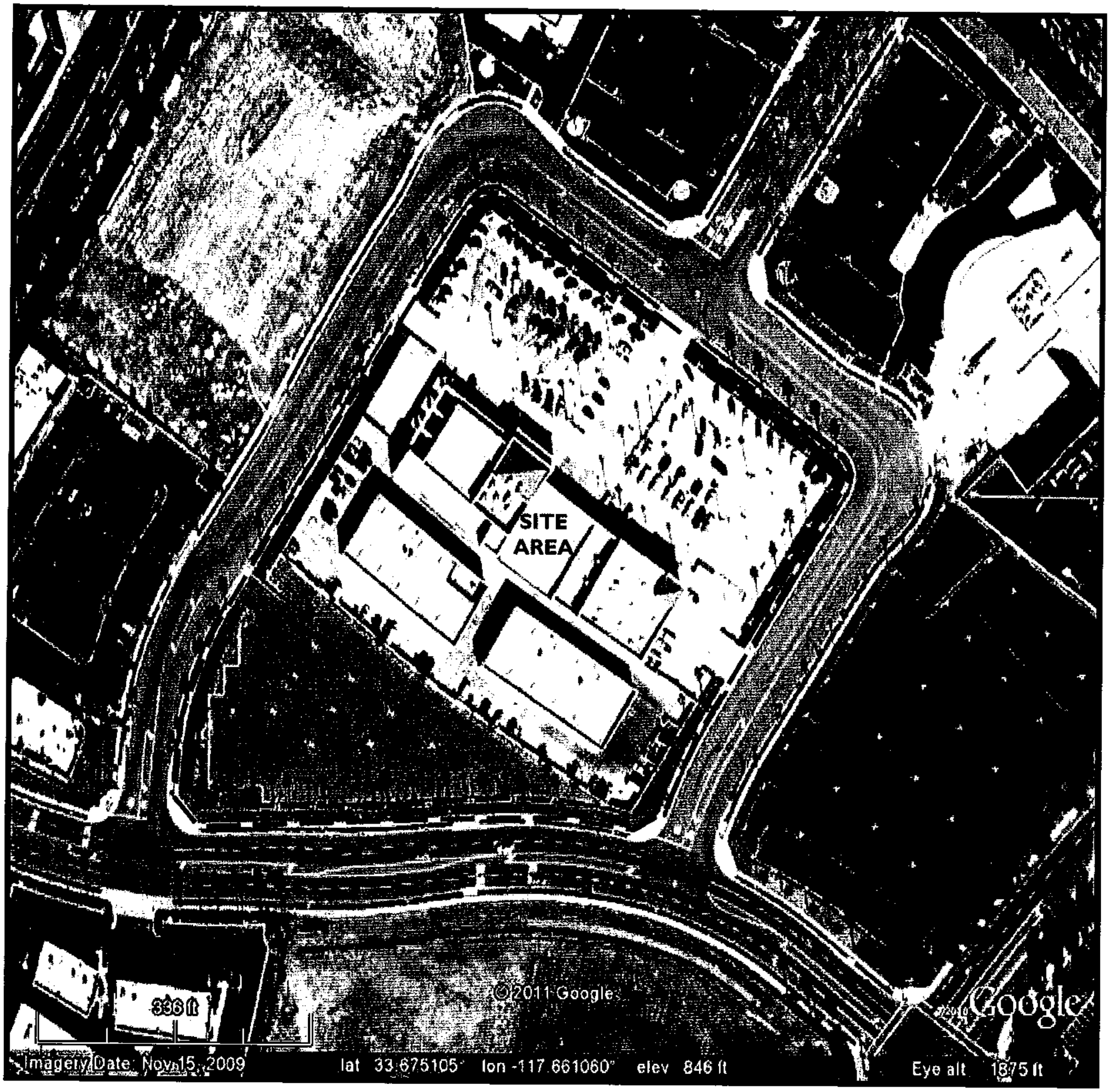
GeoTek Project No.: 0750-CR3

Modified from USGS
7.5 Topographic Map

Figure 2

General Site Topography Map

GEOTEK



Trumark Homes
The Village
City of Lake Forest
Orange County, California

GeoTek Project No.: 0750-CR3

N

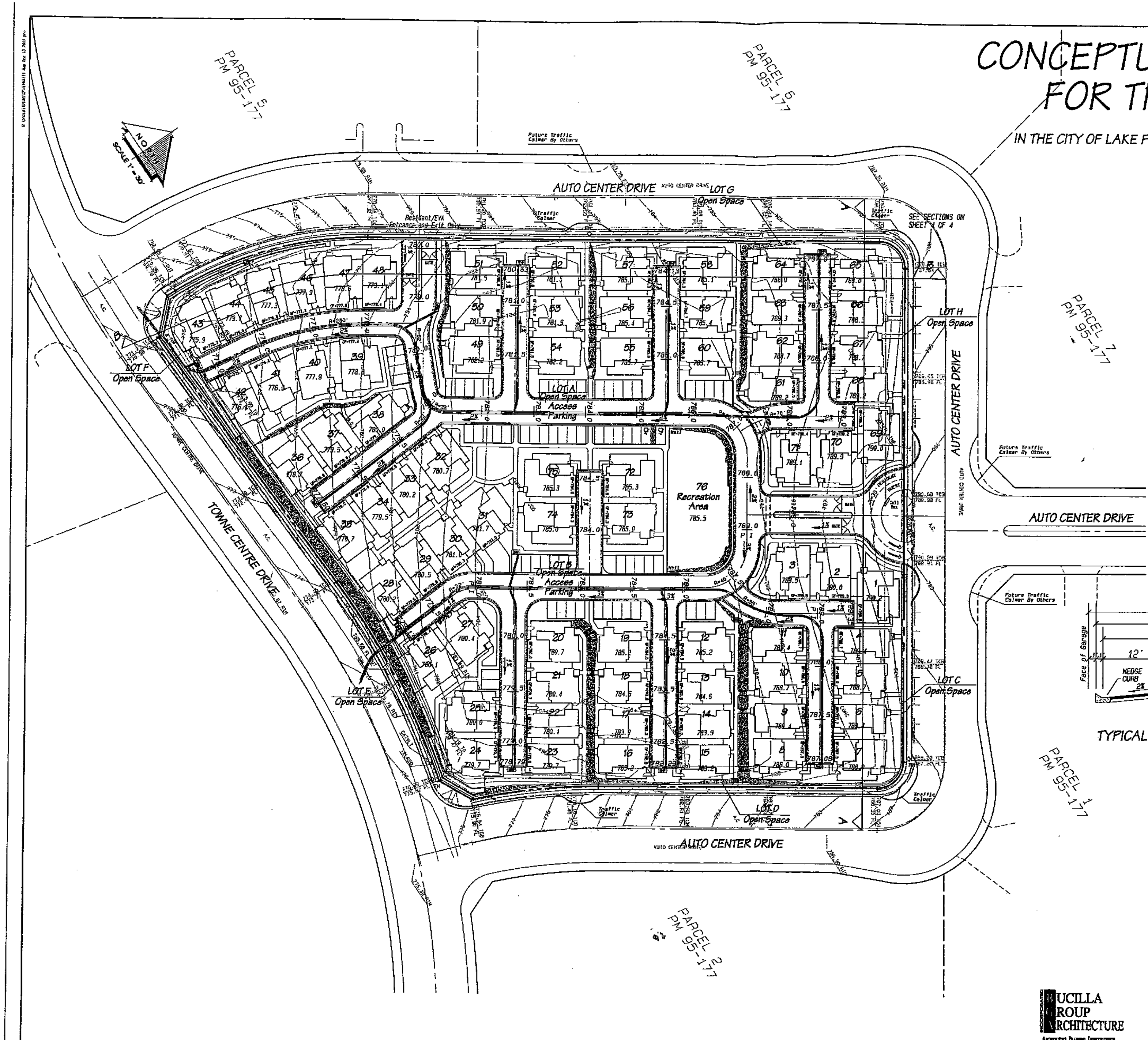
Figure 3

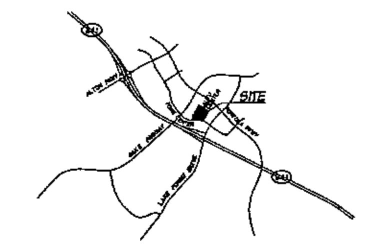
Aerial Photo

GEOTEK

CONCEPTUAL GRADING PLAN FOR TRACT NO. 17439

IN THE CITY OF LAKE FOREST, COUNTY OF ORANGE, STATE OF CALIFORNIA





VICINITY MAP
N.T.S.

LEGAL DESCRIPTION

PARCELS 3 AND 4, PARCEL MAP NO. 95-177, AS SHOWN ON A MAP RECORDED IN BOOK 292, PAGES 13-17 IN THE OFFICE OF THE COUNTY RECORDER OF ORANGE COUNTY, CA.

SITE DATA

GROSS ACREAGE = 7.01 Ac.
NET ACREAGE* - 6.91 Ac.
NUMBER OF UNITS = 75
GROSS DENSITY = 10.7 DU/Ac.
NET DENSITY = 10.85 DU/Ac.

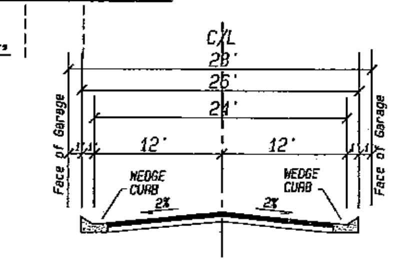
* EXCLUDES 2' SIDEWALK ESMT. AROUND SITE

BUILDING COVERAGE:	1.93 Ac.
PRIVATE YARDS:	0.99 Ac.
STREETS AND PARKING:	1.78 Ac.
DRIVEWAYS:	0.07 Ac.
LANDSCAPE AREAS:	2.24 Ac.
	7.01 Ac.

PARKING DATA

GARAGE	150 Spaces
OPEN	68 Spaces
DRIVEWAY	2 Spaces
STREET	12 Spaces

PARKING SPACES 232 (3.09 SP/UNIT)



TYPICAL PRIVATE STREET
N.T.S.

LEGEND

CATCH BASIN AND STORM DRAIN
DAYLIGHT LINE
PROPOSED FINISH CONTOUR
TENTATIVE TRACT BDY. W/ BRGS. & DIMENSIONS
DIRECTION OF GRADED SLOPE
MASONRY RETAINING WALL
LOT NUMBER
PAD ELEVATION

GRAPHIC SCALE
1 inch = 30 ft.

BUCILLA GROUP ARCHITECTURE

CONCEPTUAL GRADING PLAN FOR TRACT NO. 17439

RBF J.N. 10-108112 JANUARY 25, 2012

PLATE 1

DIGALERT DIAL TOLL FREE 1-800-227-2600 AT LEAST TWO DAYS BEFORE YOU DIG

ARCHITECT / PLANNER: BUCILLA GROUP ARCHITECTURE, 1350 REYNOLDS AVENUE, SUITE 110, IRVINE, CA 92614, PHONE: (949) 660-1587, FAX: (949) 660-1589

SOIL ENGINEER: GEOTEK, INC., 4130 FLAT ROCK DRIVE, SUITE 140, RIVERSIDE, CA 92505, PHONE: (951) 710-1160, FAX: (951) 710-1167

RBF CONSULTING — PLANNING ■ DESIGN ■ CONSTRUCTION — 14725 ALTON PARKWAY, IRVINE, CALIFORNIA 92618-2027, 949.472.3505 • FAX 949.472.8373 • www.RBF.com

PLANS PREPARED FOR: TRUMARK COMPANIES, 3911 IRVINE CENTER DRIVE, SUITE 150, IRVINE, CA 92618, PHONE: (949) 202-5786, FAX: (949) 788-1991, ATTN.: JAMES O'MALLEY

PROJECT TITLE: FOOTHILL RANCH VILLAGE
TRACT NO. 17439
JOB ADDRESS: LAKE FOREST, CALIFORNIA
SCALE: 1" = 30'
SHEET 3 OF 4

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVENUE, SUITE 514, TUSTIN, CALIFORNIA 92780
TELEPHONE: (714) 730-2122, FAX: (714) 730-5191

CRA
2904 Andros Street
Costa Mesa, CA 92626

February 12, 2002
Work Order 500312-M

Attention: Ms Colleen River

Subject: **PRECISE GRADING REPORT**
MacPherson Chevrolet, 70 Auto Centre Drive,
Foothill Ranch, City of Lake Forest, California

References: See Appendix.

Dear Ms. River:

This report presents soils engineering data and test results pertaining to the placement of compacted earth fill during precise grading operations for the MacPherson Chevrolet at 70 Auto Centre Drive, Foothill Ranch, City of Lake Forest, California. Compaction and laboratory tests for precise grading activities are summarized in the attached Table I. Approximate locations of the density tests and limits of the areas addressed under the purview of this report are presented on the enclosed plan, drawn at a scale of 1 inch equals 30 feet, prepared by Hall and Foreman, Inc., revised January 2, 2002.

Cuts, fills, required overexcavations, processing of natural ground and fill placement described herein were completed under this firm's observation and testing and are considered to have been accomplished in accordance with project specifications. Completed work is considered suitable for the proposed light commercial buildings and service bays with associated parking and driveway areas.

1.0 BACKGROUND

The subject site consisted of Parcels 3 and 4 of the former Tentative Tract 13419 which is located in the Foothill Ranch Development in the City of Lake Forest. The site is bounded on the north, west and east sides by Auto Center Drive and on the south by Towne Centre Drive.

The site was rough graded in several phases over a period of time between September of 1995 and November of 1998 under the periodic observation and testing of Pacific Soils Engineering, Inc. Rough grading operations were documented in the Reference 3 report. The site was not improved after the completion of rough grading and was exposed to the effects of natural weathering and erosion in the interim period.

As stated in the Reference 3 report, the subject site is underlain with compacted fill along the east and west sides and by the Capistrano Formation (Oso Member) sandstones within most of the of the central portion of the site. Processing of the weathered compacted fill and bedrock exposed at the surface was required during precise grading.

2.0 PRECISE GRADING

As stated above in Section 1.0, the subject site was previously rough graded as two separate contour graded parcels (Parcels 3 and 4 of Tentative Tract 13419). The subject precise grading operations transformed the two parcels into one sheet-graded building pad with attendant parking areas and drainage. Precise grading included preparation of two office building pads and two auto service bays. A summary of the observations and the results of tests collected during precise grading are presented below.

2.1 Site Preparation

Prior to the commencement of precise grading operations, all debris, trash, vegetation and other deleterious materials were removed and wasted off-site.

2.2 Overexcavation and Remedial Removals

Building Areas A through D, which includes two office buildings (A and B) and two auto service bays (C and D), were overexcavated to a depth of 5 feet below the proposed building pad grade. Overexcavation extended a minimum of 10 feet beyond building limits. The exposed bottoms overexcavated were observed by a representative of this firm. Within the parking and driveway areas, no overexcavation was required. The exposed soils at finish grade are to be scarified and recompacted during the onsite phase of the development.

2.3 Compaction Operations

Prior to placement of compacted fill in proposed fill and overexcavated areas, the exposed soils were scarified to a depth of approximately 8 inches, brought to above optimum moisture content and compacted in-place to a minimum of 90 percent of the laboratory maximum dry density as determined in accordance with ASTM Test Method: D-1557-91.

Fill materials, consisting of the soil types summarized in Table I, were then placed in thin, loose, lifts (approximately 8 inches), brought to slightly above optimum moisture content, and compacted to a minimum of 90 percent of the laboratory maximum dry density as determined in accordance with ASTM Test Method: D-1557-91. Compaction was achieved using a Caterpillar 824 rubber-tire compactor, and equipment wheel rolling.

Compaction tests were taken during the course of grading for every one to two feet of fill placed. A summary of compaction tests pertaining to precise grading within the subject site is presented in Table I. The approximate locations of these tests are shown on the accompanying precise grading plan.

2.4 Future Grading

Parking and driveway area subgrade soils should be scarified to a depth of approximately 8 inches, brought to above optimum moisture content and compacted in-place to a minimum of 90 percent of the laboratory maximum dry density as determined in accordance with ASTM Test Method: D-1557-91. Observations and test results of these grading operations will be reported in the final onsite soils report for the project.

3.0 DESIGN

It is the understanding of this firm, that the subject building pads A and B (as shown on the attached plan) will be utilized to construct light commercial buildings and that building pads C and D will be utilized to construct covered auto service bays. Attendant parking, driveways and landscape planters are also planned. Design criteria are based on the as-graded soil conditions for the building pad areas and the assumption that the proposed structures will be typical commercial structures founded on spread and continuous footings.

Bulk soil samples considered to be representative of the soils encountered within the subject building pads were collected during the precise grading operations. Expansion Index tests were then performed. Within the subject building pads, the on-site soils exhibit "very low" expansion potential when tested and classified in accordance with Table 18-I-B of the 1997 UBC. Test results are presented below:

SUMMARY OF HYDROMETER AND EXPANSION INDEX TESTING					
Sample Location	Expansion Index*	Expansion Potential**	Hydrometer Analyses		
			Sand	Silt	Clay
Bldg. A	2	Very Low	79	12	9
Bldg. B	4	Very Low	77	14	9
Bldgs. C and D	0	Very Low	81	10	9

1997 UBC Standard 18-2
1997 UBC Table 18-I-B

Based on the results of the above and other tests, the following design recommendations, applicable to the subject building pad, are presented.

3.1 Conventional Slab/Foundation Design Recommendations

The following minimum design recommendations are submitted for conventional shallow foundations and slabs in consideration of the expansion potential of the site soils and/or depth of fill.

Conventional foundations may be designed based on a "very low" expansion potential.

Allowable Bearing:	2,500 psf dead load, for interior and exterior footings, based on minimum width and depth. A 250 psf increase for every foot increase in depth and width may be used to a maximum of 3,000 psf.
Lateral Bearing:	300 psf /ft based on level conditions, and 150 psf/ft. based on 2:1 slope at the toe, to a maximum of 3,000 psf
Sliding Coefficient:	0.30
Embedment Depth (min):	24-inches exterior - (from lowest adjacent subgrade within 5 feet) 18-inches interior - (from lowest adjacent subgrade)
Footing Width (min):	12-inches for continuous footing and 24-inches for isolated spread footings

The above values may be increased as allowed by Code to resist transient loads such as wind or seismic loading. Building code and structural design considerations may govern depth and reinforcement requirements and should be evaluated.

3.2 Minimum Footing Reinforcement

Continuous footings should be reinforced with a minimum of 4 No. 4 bars, two placed near the top and two placed near the bottom of footings. Building code and structural considerations may govern reinforcement requirements and should be evaluated.

3.3 Footing Excavations

Footing excavations for the building structures should be observed by a representative of the Geotechnical Engineer of Record prior to the placement of forms and or steel. The soils exposed in the excavations should be moist, and the excavations should be free of all loose and sloughed material at the time of concrete placement.

3.4 Deepened Footings

Where foundations are to exist closer than 5 feet (horizontally) from the flow line of drainage swales, the footing should be embedded sufficiently that it extends the minimum embedment below the adjacent flow line grade.

3.5 Slab-on-Grade

Concrete slabs should have a minimum thickness of 4-inches (actual) and should be reinforced with a minimum of No. 3 bars at 18-inches on center both ways, placed at mid-height of the slab.

Floor areas considered to be moisture sensitive should be underlain with a moisture barrier such as a 10-mil Visqueen. Where employed, the Visqueen membrane should be sandwiched between two, 2-inch layers of clean (SE>30) sand. Sand may be eliminated below the Visqueen provided that all rocks and sharp objects are cleared from the subgrade prior to placement of the membrane. Sand above the membrane may be eliminated based on structural engineer recommendations. Slab subgrade moisture content should be observed by a representative of the project Geotechnical Engineer prior to the placement of sand, Visqueen, reinforcement, and concrete. Slab subgrade should be at 120 percent of optimum moisture content to a depth of 12 inches, prior to placing the sand and Visqueen membrane.

The above minimum requirements for slab thickness and reinforcement may be exceeded by structural considerations.

3.6 Seismic Design Parameters

Presented in the table below are the Simple Prescribed Parameter Values (SPPV) for the proposed subject project, as determined in accordance with the 1997 Uniform Building Code.

SEISMIC DESIGN PARAMETERS		
Seismic Parameter	Recommended Value	UBC - 1997 Chapter 16 Table No.
Seismic Zone Factor (Z)	0.4	16-I
Soil Profile Type	S_D	16–J
Seismic Source Type (Elsinore Fault) Distance: 16.5 Kilometers	B	16-U

3.7 Retaining Wall Design

On-site soils are generally "very low" in expansion potential when tested and classified in accordance with 1997 UBC Standard 18-2 and Table 18-I-B. Retaining walls should be founded on a minimum of three feet of compacted fill or suitable natural earth materials and the depth of footings should comply with the requirements of Section 3.1, above. Foundations may be designed in accordance with the recommendations presented above. Cantilevered, free standing-type retaining walls, retaining level structural quality (Sand Equivalent ≥ 30) backfill, may be designed to resist lateral pressures imposed by a fluid with an equivalent unit weight of 35 pcf plus allowances for any surcharges. Restrained retaining walls with level backfill (e.g. loading dock height walls ≤ 4 ft.) should be designed to withstand a lateral pressure of 50 psf (rectangular distribution). The backfill should be compacted to at least 90 percent of the maximum laboratory dry density as determined by ASTM Test Method: D 1557-91. The design and construction of the retaining walls should include waterproofing (where appropriate) and weep holes, subdrains, or backdrains for relieving possible hydrostatic pressures. It should be noted that the design loads presented above are based on free draining conditions without hydrostatic pressure buildup (Plate A).

The retaining wall footing excavations, backcuts, and backfill materials should be approved by the project geotechnical engineer, or his representative.

3.8 Settlement from Structural Loads

For foundations designed based on the above values and founded on the improved soils as recommended herein, total settlements under structural loads and long term secondary settlement should be less than 1-inch and differential settlements under structural loads should be less than ½-inch across 20 feet.

3.9 Exterior Flatwork

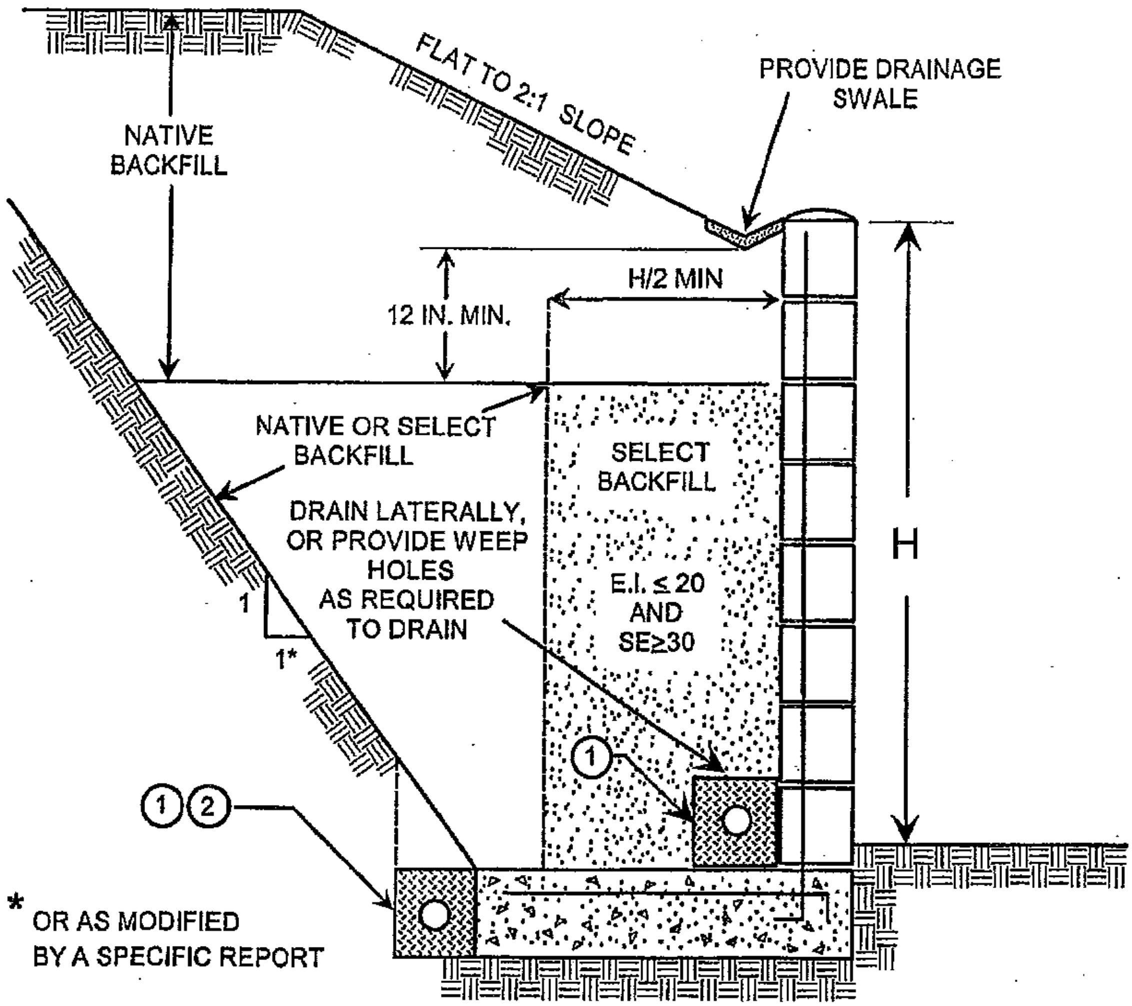
The minimum thickness of all exterior concrete should be 4 inches (actual). Subgrade soils should contain at least 120 percent of the optimum moisture content to a depth of 12-inches immediately prior to placing concrete. The need for reinforcement and doweling of exterior flatwork areas, raised porches and stairways should be evaluated by the structural engineer. Control joints should be provided at a minimum spacing of 10± feet.

3.10 Preliminary Pavement Design

An R-value test conducted on the near surface soils in the vicinity of the proposed parking lot yielded an R-value of 63. The recommended pavement sections are based on an R-value of 50 and a Traffic Index assumed to be less than 6.0. The recommended minimum pavement section is 3 inches of Asphalt Concrete over 6 inches of Aggregate Base. The Traffic Index used to model the traffic loading should be selected based on the anticipated service life and maintenance level for the subject project.

RETAINING WALL BACKFILL

N.T.S.



1. 4 INCH PERFORATED PVC, SCHEDULE 40, SDR 35 OR APPROVED ALTERNATE, PLACE PERFORATIONS DOWN AND SURROUND WITH 1 CU. FT. PER FT. OF 3/4 INCH ROCK OR APPROVED ALTERNATE AND MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT

2. OPTIONAL - PLACE DRAIN AS SHOWN WHERE MOISTURE MIGRATION IS UNDESIRABLE

PLATE A

PACIFIC SOILS ENGINEERING, INC

3002 DOW AVENUE, SUITE 514, TUSTIN CALIFORNIA 92780

VER. 4/00

Pavement subgrade soils should be at slightly above optimum moisture condition and should be compacted to at least 90 percent of maximum laboratory dry density as determined in accordance with the ASTM Test Method:D 1557-91. Aggregate base should consist of Class 2 (Caltrans) aggregate base and be compacted to at least 95 percent of maximum laboratory dry density as determined in accordance with the ASTM Test Method:D 1557-91.

3.11 Utility Trench Excavation & Backfill

All utility trenches should be shored or laid back in accordance with applicable OSHA standards. Mainline and lateral utility trench backfill should be compacted to at least 90 percent of maximum laboratory dry density as determined in accordance with ASTM Test Method: D 1557-91. On-site soils may not be suitable for use as bedding materials but will be suitable for use in backfill.

Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable. Under-slab trenches should also be compacted to project specifications. The geotechnical engineer should be notified for observation and testing prior to placement of the membrane and slab reinforcement.

It is suggested that the utility trenches be backfilled with concrete slurry where they intercept the perimeter footings (under the footing) to reduce the potential for moisture migration below the slab area.

3.12 Chemical Analyses

During grading, additional samples of site soils were collected and tested. The test results indicated sulfate concentration levels are in a range that does not require the use of sulfate resistant concrete. Although Table 19-A-4 of the 1997 UBC indicates that the use of sulfate resistant concrete is not required at these levels, due to the high solubility and potential migration of some sulfates (such as those in fertilizers), this firm recommends the use of sulfate resistant concrete.

3.13 Site Drainage

Final site grading should assure positive drainage away from structures. Planter areas should be provided with area drains to transmit irrigation and rainwater away from structures. The use of gutters and down spouts to carry roof drainage well away from structures is recommended. Raised planters should be provided with a positive means to remove water through the face of the containment wall.

This report presents information and data relative to precise grading at the subject building pad. Representative(s) of this firm conducted periodic tests and made observations during the progress of the construction in an effort to determine whether compliance with the project drawings, specifications and applicable Building Code was being obtained. The presence of our personnel during the work progress did not involve any direct supervision of the contractor or his work forces. Professional and technical advice and suggestions were provided to the owner and/or his designated representative based upon our observations. Completed work under the purview of this report is considered to be in compliance with the project specifications, acceptable to this firm and is considered suitable and adequate for the intended use (light commercial building). Conditions of the referenced reports remain applicable unless specifically superseded herein.

PSE appreciates the opportunity to be of service to you and your organization. If you have any questions or should you require any additional information, please contact the undersigned.

Respectfully submitted,
PACIFIC SOILS ENGINEERING, INC.

DOUGLAS C. McCORMICK
Civil Engineering Associate

Reviewed by:

AZZAM J. ALWASH, Ph.D./RGE 2172
RCE 42518/Reg. Exp.: 3-31-04
Manager of Geotechnical Services

CARISA ENDRIZZI-DAVIS/CEG 1987
Reg. Exp.: 12-31-03
Certified Engineering Geologist

Distribution:
(4) Addressee
(2) City of Lake Forest – Grading Department, Attn: Jim Brogan
CED:DCM:AJA:-500312M, February 13, 2002

APPENDIX

Selected References

1. Geotechnical Review of Structural Plans, MacPherson Chevrolet Foothill Ranch, City of Lake Forest, California; Report by PSE, dated January 2, 2002 (W.O. 500312M).

2. Geotechnical Review of Precise Grading Plan, MacPherson Chevrolet, Foothill Ranch, (Formerly Parcels 3 and 4 of Tentative Tract 13419), Foothill Ranch; Report by Pacific Soils Engineering, Inc., dated July 27, 2000 (W.O. 500312M).

3. Project Grading Report, Tentative Parcel Map 95-177, Parcels 1 Through 7, Inclusive, A Portion of Planning Area 8, Tentative Tract 13419, Foothill Ranch, County of Orange, California; Report by Pacific Soils Engineering, Inc. (PSE), dated February 1, 1999 (W.O. 500312-G).

4. International Conference of Building Officials (ICBO), 1997 Uniform Building Code, Volume 2, Structural Engineering Design Provisions.

5. Map of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, prepared by California Department of Conservation, Division of Mines and Geology (CDMG), published by ICBO, February 1998.

6. Guidelines for Evaluating and Mitigating Seismic Hazards in California; published by California Department of Conservation, Division of Mines and Geology, 1997 (Special Publication 117).

TABLE I

Laboratory Maximum Dry Density: ASTM D 1557-91

Soil Type & Description	Opt. Moist. (%)	Maximum Dry Density (lbs./cu.ft.)
A - White Silty Sand	8.9	126.9

LEGEND

101 Indicates test in compacted fill
101FG - Indicates compaction test on finish grade
-R, -R2, -R3, etc. Indicates retest of failed areas

Depth/Elevation

FG Indicates finished grade elevation
778 Indicates approximate test elevation

TEST TYPE:

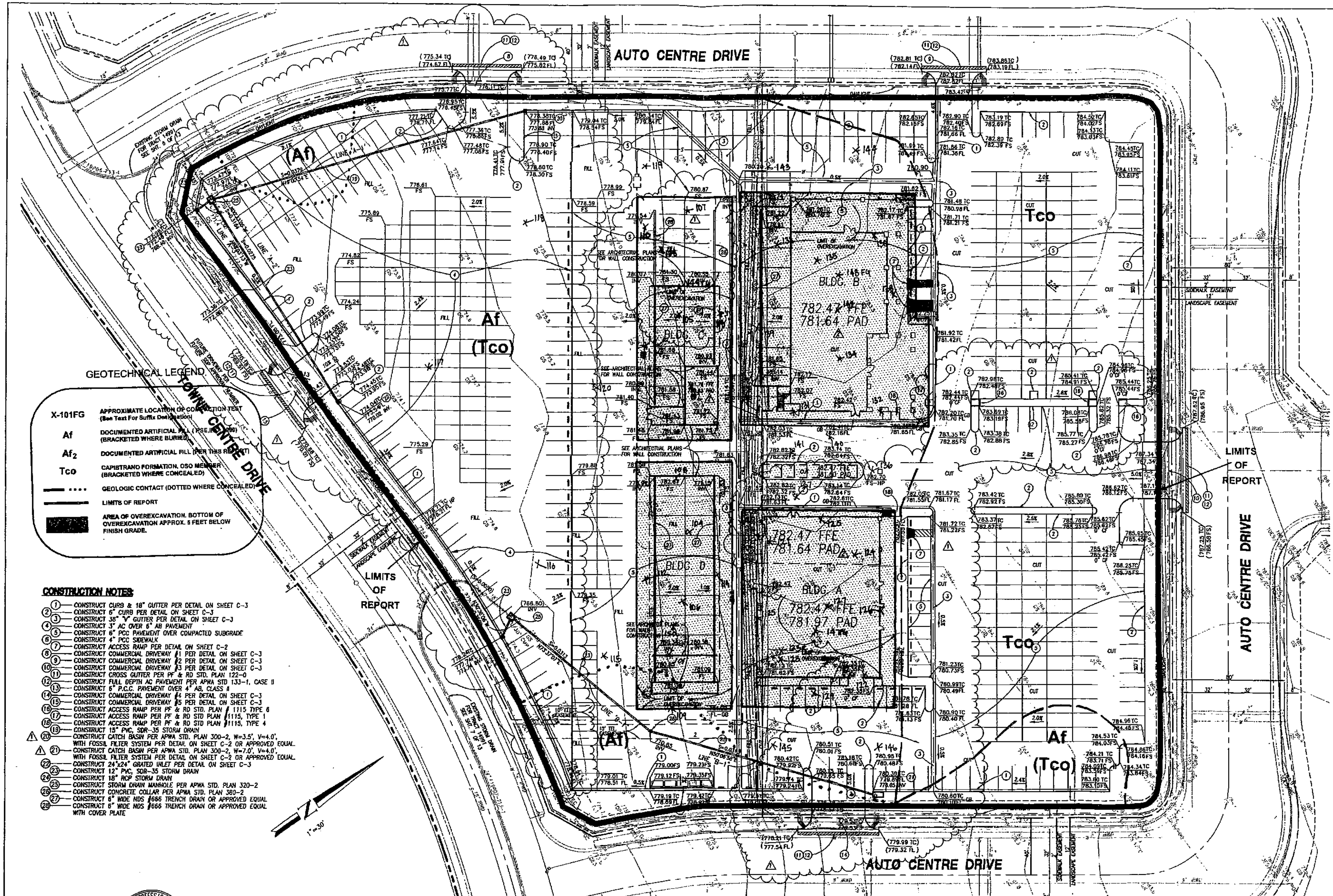
All tests were taken by Campbell Pacific Nuclear Testing Gauge.

TABLE I

Date	Test No.	Test	Depth or Elev.	Moisture Field	Moisture Opt.	Unit Dry Wt. Max.	Unit Dry Wt. Field	Rel Comp.	Soil Type	Test Type	Proj. Spec.	Pass/Fail
1/21/2002	101	Building D	777	10.7	8.9	129.6	119.3	92	A	N	90	Pass
1/21/2002	102	Building C	777	11.2	8.9	129.6	118.2	91	A	N	90	Pass
1/21/2002	103	Building C	778	9.9	8.9	129.6	118.9	92	A	N	90	Pass
1/21/2002	104	Building D	778	10.1	8.9	129.6	120.1	93	A	N	90	Pass
1/21/2002	105	Building C	779	9.6	8.9	129.6	117.9	91	A	N	90	Pass
1/21/2002	106	Building D	779	10.9	8.9	129.6	118.7	92	A	N	90	Pass
1/22/2002	107	Buiding C	779	11.2	8.9	129.6	119.1	92	A	N	90	Pass
1/22/2002	108	Building D	780	10.1	8.9	129.6	120.4	93	A	N	90	Pass
1/22/2002	109	Building D	779	9.8	8.9	129.6	119.6	92	A	N	90	Pass
1/22/2002	110	Building C	780	10.9	8.9	129.6	118.2	91	A	N	90	Pass
1/22/2002	111	Building C	780	11.4	8.9	129.6	118.6	92	A	N	90	Pass
1/22/2002	112	Building D	780	10.2	8.9	129.6	120.1	93	A	N	90	Pass
1/22/2002	113	Building C	781	10.9	8.9	129.6	120.5	93	A	N	90	Pass
1/22/2002	114	Building D	781	9.4	8.9	129.6	119.4	92	A	N	90	Pass
1/22/2002	115	Parking Lot Adj. Building D	778	10.7	8.9	129.6	118.9	92	A	N	90	Pass
1/22/2002	116	Parking Lot Adj. Building D	779	10.1	8.9	129.6	119.5	92	A	N	90	Pass
1/22/2002	117	Parking Lot Adj. Building C	776	10.7	8.9	129.6	117.9	91	A	N	90	Pass
1/22/2002	118	Parking Lot Adj. Building C	777	11.2	8.9	129.6	119.2	92	A	N	90	Pass
1/22/2002	119	Parking Lot Adj. Building C	778	9.4	8.9	129.6	118.5	91	A	N	90	Pass
1/22/2002	120	Parking Lot Adj. Building C	779	9.7	8.9	129.6	118.2	91	A	N	90	Pass
1/22/2002	121	Building A	777	9.9	8.9	129.6	119.4	92	A	N	90	Pass
1/23/2002	122	Building A	777	10.2	8.9	129.6	120.1	93	A	N	90	Pass
1/23/2002	123	Building A	778	9.1	8.9	129.6	116.1	90	A	N	90	Fail
1/23/2002	123-R	Building A	778	9.7	8.9	129.6	117.8	91	A	N	90	Pass
1/23/2002	124	Building A	778	10.3	8.9	129.6	118.6	92	A	N	90	Pass
1/23/2002	125	Building A	779	10.2	8.9	129.6	119.0	92	A	N	90	Pass
1/23/2002	126	Building A	780	11.1	8.9	129.6	119.8	92	A	N	90	Pass
1/23/2002	127	Building A	781	10.1	8.9	129.6	119.2	92	A	N	90	Pass
1/23/2002	128	Building A	780	9.7	8.9	129.6	120.8	93	A	N	90	Pass
1/23/2002	129	Building A	780	10.2	8.9	129.6	118.8	92	A	N	90	Pass
1/23/2002	130	Building B	777	10.6	8.9	129.6	119.9	93	A	N	90	Pass
1/23/2002	131	Building B	777	9.8	8.9	129.6	120.4	93	A	N	90	Pass
1/23/2002	132	Building B	778	9.8	8.9	129.6	119.8	92	A	N	90	Pass

TABLE I

Date	Test No.	Test	Depth or Elev	Moisture Field	Moisture Opt.	Unit Dry Wt. Max.	Unit Dry Wt. Field	Rel Comp.	Soil Type	Test Type	Proj. Spec.	Pass/Fail
1/23/2002	133	Building B	778	9.6	8.9	129.6	120.2	93	A	N	90	Pass
1/24/2002	134	Building B	779	10.4	8.9	129.6	119.3	92	A	N	90	Pass
1/24/2002	135	Building B	780	10.9	8.9	129.6	118.1	91	A	N	90	Pass
1/24/2002	136	Drive Between Buildings A & B	778	10.2	8.9	129.6	118.7	92	A	N	90	Pass
1/24/2002	137	Drive Between Buildings A & B	779	10.9	8.9	129.6	118.3	91	A	N	90	Pass
1/24/2002	138	Building B	780	9.6	8.9	129.6	119.7	92	A	N	90	Pass
1/24/2002	139	Building B	780	10.7	8.9	129.6	117.9	91	A	N	90	Pass
1/24/2002	140	Building B	780	10.4	8.9	129.6	118.7	92	A	N	90	Pass
1/24/2002	141	Drive Between Buildings A & B	780	10.6	8.9	129.6	119.1	92	A	N	90	Pass
1/24/2002	142	Building B	781	9.9	8.9	129.6	120.2	93	A	N	90	Pass
1/24/2002	143	Parking Lot North of Building B	777	10.1	8.9	129.6	119.7	92	A	N	90	Pass
1/24/2002	144	Parking Lot North of Building B	779	9.8	8.9	129.6	120.4	93	A	N	90	Pass
1/24/2002	145	Parking Lot South of Building A	777	9.6	8.9	129.6	120.7	93	A	N	90	Pass
1/24/2002	146	Parking Lot South of Building A	779	9.9	8.9	129.6	120.0	93	A	N	90	Pass
2/1/2002	147FG	Building A	782.0	10.6	8.9	129.6	117.1	90	A	N	90	Pass
2/1/2002	148FG	Building B	782.0	9.8	8.9	129.6	118.8	92	A	N	90	Pass
2/1/2002	149FG	Building C	780.5	9.6	8.9	129.6	118.5	91	A	N	90	Pass
2/1/2002	150FG	Building D	781.0	10.9	8.9	129.6	117.5	91	A	N	90	Pass



GEOTECHNICAL LEGEND

X-101FG	APPROXIMATE LOCATION OF COMPACTION TEST (See Text For Suffix Designation)
Af	DOCUMENTED ARTIFICIAL FILL (PSE, IN 1999) (BRACKETED WHERE BURIED)
Af_2	DOCUMENTED ARTIFICIAL FILL (PER THIS REPORT)
Tco	CAPISTRANO FORMATION, OSO MEMBER (BRACKETED WHERE CONCEALED)
	GEOLOGIC CONTACT (DOTTED WHERE CONCEALED)
	LIMITS OF REPORT
	AREA OF OVEREXCAVATION. BOTTOM OF OVEREXCAVATION APPROX. 5 FEET BELOW FINISH GRADE.

CONSTRUCTION NOTES:

1. CONSTRUCT CURB & 18" GUTTER PER DETAIL ON SHEET C-3
2. CONSTRUCT 6" CURB PER DETAIL ON SHEET C-3
3. CONSTRUCT 38" "V" GUTTER PER DETAIL ON SHEET C-3
4. CONSTRUCT 3" AC OVER 6" AB PAVEMENT
5. CONSTRUCT 6" PCC PAVEMENT OVER COMPACTED SUBGRADE
6. CONSTRUCT 4" PCC SIDEWALK
7. CONSTRUCT ACCESS RAMP PER DETAIL ON SHEET C-2
8. CONSTRUCT COMMERCIAL DRIVEWAY #1 PER DETAIL ON SHEET C-3
9. CONSTRUCT COMMERCIAL DRIVEWAY #2 PER DETAIL ON SHEET C-3
10. CONSTRUCT COMMERCIAL DRIVEWAY #3 PER DETAIL ON SHEET C-3
11. CONSTRUCT CROSS GUTTER PER PF & RD STD. PLAN 122-0
12. CONSTRUCT FULL DEPTH AC PAVEMENT PER APWA STD 133-1, CASE II
13. CONSTRUCT 6" P.C.C. PAVEMENT OVER 4" AB, CLASS II
14. CONSTRUCT COMMERCIAL DRIVEWAY #4 PER DETAIL ON SHEET C-3
15. CONSTRUCT COMMERCIAL DRIVEWAY #5 PER DETAIL ON SHEET C-3
16. CONSTRUCT ACCESS RAMP PER PF & RD STD. PLAN # 1115 TYPE 6
17. CONSTRUCT ACCESS RAMP PER PF & RD STD PLAN #1115, TYPE 1
18. CONSTRUCT ACCESS RAMP PER PF & RD STD PLAN #1115, TYPE 4
19. CONSTRUCT 15" PVC, SDR-35 STORM DRAIN
20. △1 CONSTRUCT CATCH BASIN PER APWA STD. PLAN 300-2, W=3.5', V=4.0', WITH FOSSIL FILTER SYSTEM PER DETAIL ON SHEET C-2 OR APPROVED EQUAL.
21. △1 CONSTRUCT CATCH BASIN PER APWA STD. PLAN 300-2, W=7.0', V=4.0', WITH FOSSIL FILTER SYSTEM PER DETAIL ON SHEET C-2 OR APPROVED EQUAL.
22. CONSTRUCT 24"x24" GRATED INLET PER DETAIL ON SHEET C-3
23. CONSTRUCT 12" PVC, SDR-35 STORM DRAIN
24. CONSTRUCT 18" RCP STORM DRAIN
25. CONSTRUCT STORM DRAIN MANHOLE PER APWA STD. PLAN 320-2
26. CONSTRUCT CONCRETE COLLAR PER APWA STD. PLAN 380-2
27. CONSTRUCT 6" WIDE NDS #666 TRENCH DRAIN OR APPROVED EQUAL
28. CONSTRUCT 6" WIDE NDS #666 TRENCH DRAIN OR APPROVED EQUAL WITH COVER PLATE

REGISTERED PROFESSIONAL ENGINEER
ALAN PALERMO
No. 056822
Exp. 6/30/05
CIVIL
STATE OF CALIFORNIA

GRAPHIC SCALE
(IN FEET)
1 inch = 30 ft.

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVENUE SUITE 514 TUSTIN CA 92780 (714) 730-2122
W.O. 500312-M DATE: 2-12-02

DATE	BY	DESCRIPTION	APPV

REVISIONS

PRECISE GRADING PLAN

CITY OF LAKE FOREST
PUBLIC WORKS DEPARTMENT

C-4
PC20824
GR-1072/~~P019050~~
SHEET 4 OF 6

DRAWING NAME:
PRECISE GRADING PLAN
MACPHERSON CHEVROLET
70 AUTO CENTRE DRIVE
FOOTHILL RANCH, CALIFORNIA

PREPARED BY:
Hall & Foreman, Inc.
Civil Engineering · Planning · Surveying · Public Works
203 North Golden Circle Drive, Suite 300 · Santa Ana, CA 92705-4010 · 714/665-4500
PREPARED UNDER THE SUPERVISION OF:
ALAN PALERMO, RCE 056822 EXP. 06/30/05 DATE

DESIGNED BY:	MSO	DATE 6/5/00
DRAWN BY:	MSO	DATE 6/5/00
CHECKED BY:	AP	DATE 5/18/00

NUMBER	DATE	REVISIONS
△	01/02/02	REVISED PAD ELEVATIONS TO MATCH SOILS REPORT
△	12/20/00	REVISED GRADES TO S'LY PARKING LOT. ALL DRIVEWAYS, AND GRADES AROUND NEW BUILDING FOOTPRINTS
	12/20/00	FINAL PLAN CHECK SUBMITTAL
	9/20/00	PLAN CHECK SUBMITTAL #1

S:\00286\ENG\SHEETS\00286pg2.dwg 1-21-02 4:32:51 pm EST

APPENDIX A

PRECISE GRADING REPORT BY PSE (2002)

Tract No. 17439
City of Lake Forest, Orange County, California
Project No. 0750-CR3

GEOTEK

APPENDIX B

EARTHWORK AND GRADING GUIDELINES

Tract No. 17439
City of Lake Forest, Orange County, California
Project No. 0750-CR3

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the Uniform Building Code, CBC (2010) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.

5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.
6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
    a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
    b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative. Typical procedures are similar to those indicated on Plate G-4.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed (see Plates G-1, G-2 and G-3) unless otherwise specifically indicated in the text of this report.

2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Subdrainage

1. Subdrainage systems should be provided in canyon bottoms prior to placing fill, and behind buttress and stabilization fills and in other areas indicated in the report. Subdrains should conform to schematic diagrams G-1 and G-5, and be acceptable to our representative.
2. For canyon subdrains, runs less than 500 feet may use six-inch pipe. Typically, runs in excess of 500 feet should have the lower end as eight-inch minimum.
3. Filter material should be clean, 1/2 to 1-inch gravel wrapped in a suitable filter fabric. Class 2 permeable filter material per California Department of Transportation Standards tested by this office to verify its suitability, may be used without filter fabric. A sample of the material should be provided to the Soils Engineer by the contractor at least two working days before it is delivered to the site. The filter should be clean with a wide range of sizes.
4. Approximate delineation of anticipated subdrain locations may be offered at 40-scale plan review stage. During grading, this office would evaluate the necessity of placing additional drains.
5. All subdrainage systems should be observed by our representative during construction and prior to covering with compacted fill.
6. Subdrains should outlet into storm drains where possible. Outlets should be located and protected. The need for backflow preventers should be assessed during construction.
7. Consideration should be given to having subdrains located by the project surveyors.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).
2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:

a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.

b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.

4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
   a) They are not placed in concentrated pockets;
   b) There is a sufficient percentage of fine-grained material to surround the rocks;
   c) The distribution of the rocks is observed by, and acceptable to, our representative.

5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal (see Plate G-4). On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.

6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.

2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.

3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.

4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.

5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

Keyways, Buttress and Stabilization Fills

Keyways are needed to provide support for fill slope and various corrective procedures.

1. Side-hill fills should have an equipment-width key at their toe excavated through all surficial soil and into competent material and tilted back into the hill (Plates G-2, G-3). As the fill is elevated, it should be benched through surficial soil and slopewash, and into competent bedrock or other material deemed suitable by our representatives (See Plates G-1, G-2, and G-3).
2. Fill over cut slopes should be constructed in the following manner:
   a) All surficial soils and weathered rock materials should be removed at the cut-fill interface.
   b) A key at least one and one-half (1.5) equipment width wide (or as needed for compaction), and tipped at least one (1) foot into slope, should be excavated into competent materials and observed by our representative.
   c) The cut portion of the slope should be excavated prior to fill placement to evaluate if stabilization is necessary. The contractor should be responsible for any additional earthwork created by placing fill prior to cut excavation. (see Plate G-3 for schematic details.)
3. Daylight cut lots above descending natural slopes may require removal and replacement of the outer portion of the lot. A schematic diagram for this condition is presented on Plate G-2.
4. A basal key is needed for fill slopes extending over natural slopes. A schematic diagram for this condition is presented on Plate G-2.
5. All fill slopes should be provided with a key unless within the body of a larger overall fill mass. Please refer to Plate G-3 for specific guidelines.

Anticipated buttress and stabilization fills are discussed in the text of the report. The need to stabilize other proposed cut slopes will be evaluated during construction. Plate G-5 shows a schematic of buttress construction.

1. All backcuts should be excavated at gradients of 1:1 or flatter. The backcut configuration should be determined based on the design, exposed conditions, and need to maintain a minimum fill width and provide working room for the equipment.
2. On longer slopes, backcuts and keyways should be excavated in maximum 250 feet long segments. The specific configurations will be determined during construction.
3. All keys should be a minimum of two (2) feet deep at the toe and slope toward the heel at least one foot or two (2%) percent, whichever is greater.
4. Subdrains are to be placed for all stabilization slopes exceeding 10 feet in height. Lower slopes are subject to review. Drains may be required. Guidelines for subdrains are presented on Plate G-5.

5. Benching of backcuts during fill placement is required.

Lot Capping

1. When practical, the upper three (3) feet of material placed below finish grade should be comprised of the least expansive material available. Preferably, highly and very highly expansive materials should not be used. We will attempt to offer advise based on visual evaluations of the materials during grading, but it must be realized that laboratory testing is needed to evaluate the expansive potential of soil. Minimally, this testing takes two (2) to four (4) days to complete.
2. Transition lots (cut and fill) both per plan and those created by remedial grading (e.g. lots above stabilization fills, along daylight lines, above natural slopes, etc.) should be capped with a minimum three foot thick compacted fill blanket.
3. Cut pads should be observed by our representative(s) to evaluate the need for overexcavation and replacement with fill. This may be necessary to reduce water infiltration into highly fractured bedrock or other permeable zones, and/or due to differing expansive potential of materials beneath a structure. The overexcavation should be at least three feet. Deeper overexcavation may be recommended in some cases.

ROCK PLACEMENT AND ROCK FILL GUIDELINES

It is anticipated that large quantities of oversize material would be generated during grading. It's likely that such materials may require special handling for burial. Although alternatives may be developed in the field, the following methods of rock disposal are recommended on a preliminary basis.

Limited Larger Rock

When materials encountered are principally soil with limited quantities of larger rock fragments or boulders, placement in windrows is recommended. The following procedures should be applied:

1. Oversize rock (greater than 8 inches) should be placed in windrows.
   a) Windrows are rows of single file rocks placed to avoid nesting or clusters of rock.
   b) Each adjacent rock should be approximately the same size (within ~one foot in diameter).
   c) The maximum rock size allowed in windrows is four feet
2. A minimum vertical distance of three feet between lifts should be maintained. Also, the windrows should be offset from lift to lift. Rock windrows should not be closer than 15 feet to the face of fill slopes and sufficient space must be maintained for proper slope construction (see Plate G-4).
3. Rocks greater than eight inches in diameter should not be placed within seven feet of the finished subgrade for a roadway or pads and should be held below the depth of the lowest utility. This will allow easier trenching for utility lines.

4. Rocks greater than four feet in diameter should be broken down, if possible, or they may be placed in a dozer trench. Each trench should be excavated into the compacted fill a minimum of one foot deeper than the largest diameter of rock.
   a) The rock should be placed in the trench and granular fill materials (SE>30) should be flooded into the trench to fill voids around the rock.
   b) The over size rock trenches should be no closer together than 15 feet from any slope face.
   c) Trenches at higher elevation should be staggered and there should be a minimum of four feet of compacted fill between the top of the one trench and the bottom of the next higher trench.
   d) It would be necessary to verify 90 percent relative compaction in these pits. A 24 to 72 hour delay to allow for water dissipation should be anticipated prior to additional fill placement.

Structural Rock Fills

If the materials generated for placement in structural fills contains a significant percentage of material more' than six (6) inches in one dimension, then placement using conventional soil fill methods with isolated windrows would not be feasible. In such cases the following could be considered:

1. Mixes of large rock or boulders may be placed as rock fill. They should be below the depth of all utilities both on pads and in roadways and below any proposed swimming pools or other excavations. If these fills are placed within seven (7) feet of finished grade, they may effect foundation design.
2. Rock fills are required to be placed in horizontal layers that should **not exceed two feet in thickness, or the maximum rock size present, which ever is less.** All rocks exceeding two feet should be broken down to a smaller size, windrowed (see above), or disposed of in non-structural fill areas. Localized larger rock up to 3 feet in largest dimension may be placed in rock fill as follows:
   a) individual rocks are placed in a given lift so as to be roughly 50% exposed above the typical surface of the fill ,
   b) loaded rock trucks or alternate compactors are worked around the rock on all sides to the satisfaction of the soil engineer,
   c) the portion of the rock above grade is covered with a second lift.
3. Material placed in each lift should be well graded. No unfilled spaces (voids) should be permitted in the rock fill.

Compaction Procedures

Compaction of rock fills is largely procedural. The following procedures have been found to generally produce satisfactory compaction.

1. Provisions for routing of construction traffic over the fill should be implemented.

a) Placement should be by rock trucks crossing the lift being placed and dumping at its edge.

b) The trucks should be routed so that each pass across the fill is via a different path and that all areas are uniformly traversed.

c) The dumped piles should be knocked down and spread by a large dozer (D-8 or larger suggested). (Water should be applied before and during spreading.)

2. Rock fill should be generously watered (sluiced)
   a) Water should be applied by water trucks to the:
      i) dump piles,
      ii) front face of the lift being placed and,
      iii) surface of the fill prior to compaction.
   b) No material should be placed without adequate water.
   c) The number of water trucks and water supply should be sufficient to provide constant water.
   d) Rock fill placement should be suspended when water trucks are unavailable:
      i) for more than 5 minutes straight, or,
      ii) for more than 10 minutes/hour.

3. In addition to the truck pattern and at the discretion of the soil engineer, large, rubber tired compactors may be required.
   a) The need for this equipment will depend largely on the ability of the operators to provide complete and uniform coverage by wheel rolling with the trucks.
   b) Other large compactors will also be considered by the soil engineer provided that required compaction is achieved.

4. Placement and compaction of the rock fill is largely procedural. Observation by trenching should be made to check:
   a) the general segregation of rock size,
   b) for any unfilled spaces between the large blocks, and
   c) the matrix compaction and moisture content.

5. Test fills may be required to evaluate relative compaction of finer grained zones or as deemed appropriate by the soil engineer.
   a) A lift should be constructed by the methods proposed, as proposed

6. Frequency of the test trenching is to be at the discretion of the soil engineer. Control areas may be used to evaluate the contractors procedures.

7. A minimum horizontal distance of 15 feet should be maintained from the face of the rock fill and any finish slope face. At least the outer 15 feet should be built of conventional fill materials.

Piping Potential and Filter Blankets

Where conventional fill is placed over rock fill, the potential for piping (migration) of the fine grained material from the conventional fill into rock fills will need to be addressed.

The potential for particle migration is related to the grain size comparisons of the materials present and in contact with each other. Provided that 15 percent of the finer soil is larger than the effective pore size of the coarse soil, then particle migration is substantially mitigated. This can be accomplished with a well-graded matrix material for the rock fill and a zone of fill similar to the matrix above it. The specific gradation of the fill materials placed during grading must be known to evaluate the need for any type of filter that may be necessary to cap the rock fills. This, unfortunately, can only be accurately determined during construction.

In the event that poorly graded matrix is used in the rock fills, properly graded filter blankets 2 to 3 feet thick separating rock fills and conventional fill may be needed. As an alternative, use of two layers of filter fabric (Mirafi 700 x or equivalent) could be employed on top of the rock fill. In order to mitigate excess puncturing, the surface of the rock fill should be well broken down and smoothed prior to placing the filter fabric. The first layer of the fabric may then be placed and covered with relatively permeable fill material (with respect to overlying material) 1 to 2 feet thick. The relative permeable material should be compacted to fill standards. The second layer of fabric should be placed and conventional fill placement continued.

Subdrainage

Rock fill areas should be tied to a subdrainage system. If conventional fill is placed that separates the rock from the main canyon subdrain, then a secondary system should be installed. A system consisting of an adequately graded base (3 to 4 percent to the lower side) with a collector system and outlets may suffice.

Additionally, at approximately every 25 foot vertical interval, a collector system with outlets should be placed at the interface of the rock fill and the conventional fill blanketing a fill slope

Monitoring

Depending upon the depth of the rock fill and other factors, monitoring for settlement of the fill areas may be needed following completion of grading. Typically, if rock fill depths exceed 40 feet, monitoring would be recommend prior to construction of any settlement sensitive improvements. Delays of 3 to 6 months or longer can be expected prior to the start of construction.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.

2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:

   a) shallow (12 + inches) under slab interior trenches and,

   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.

3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.

4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.

5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

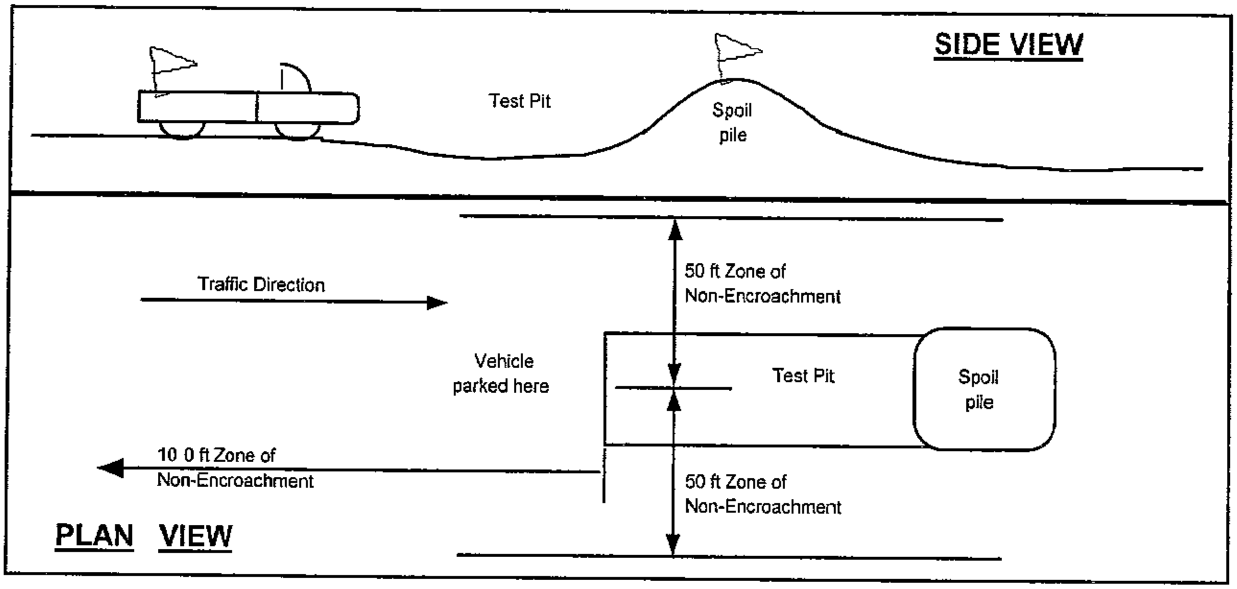
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

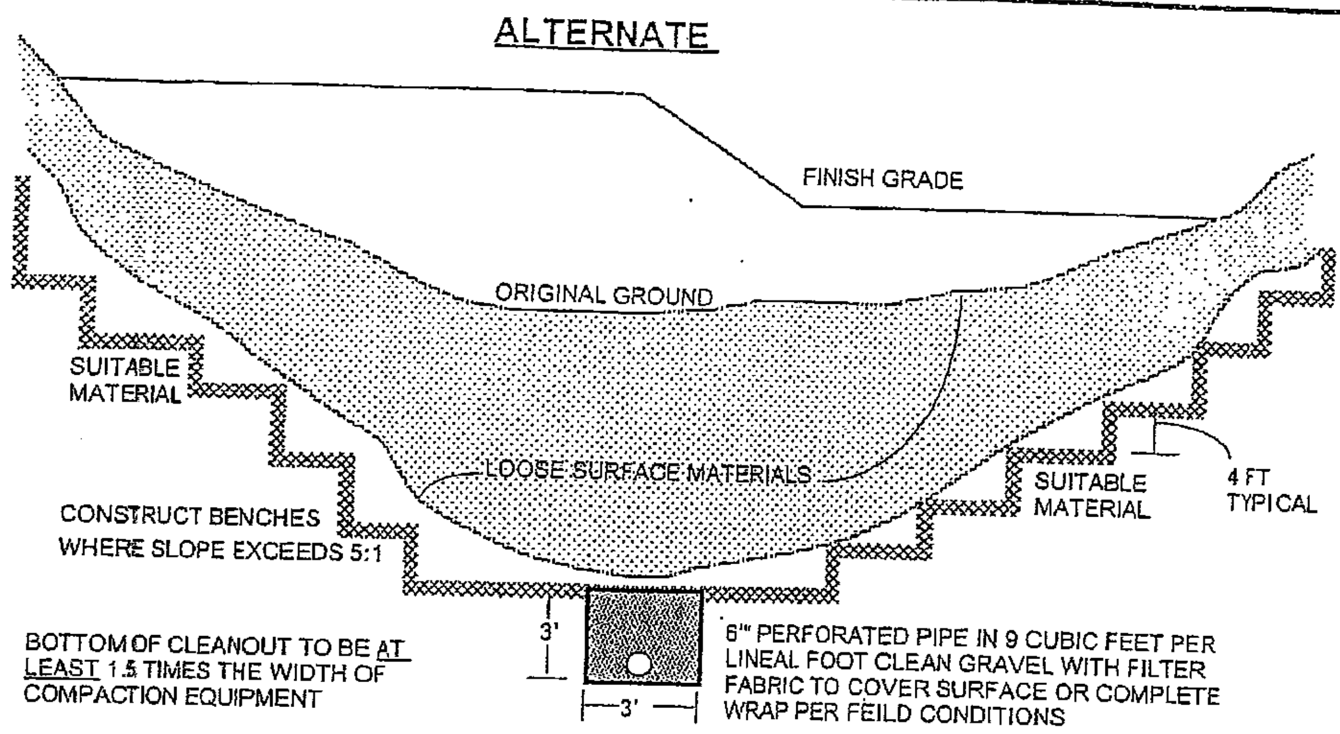
Procedures

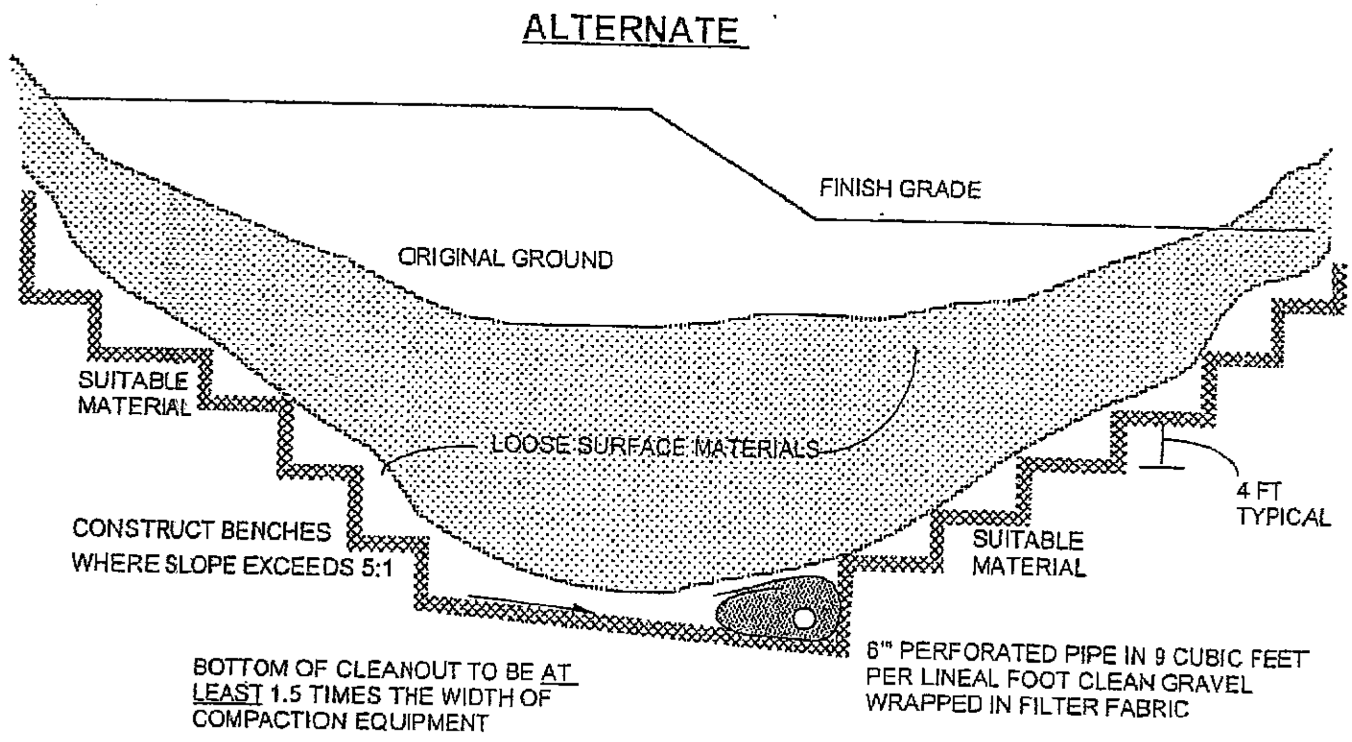
In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

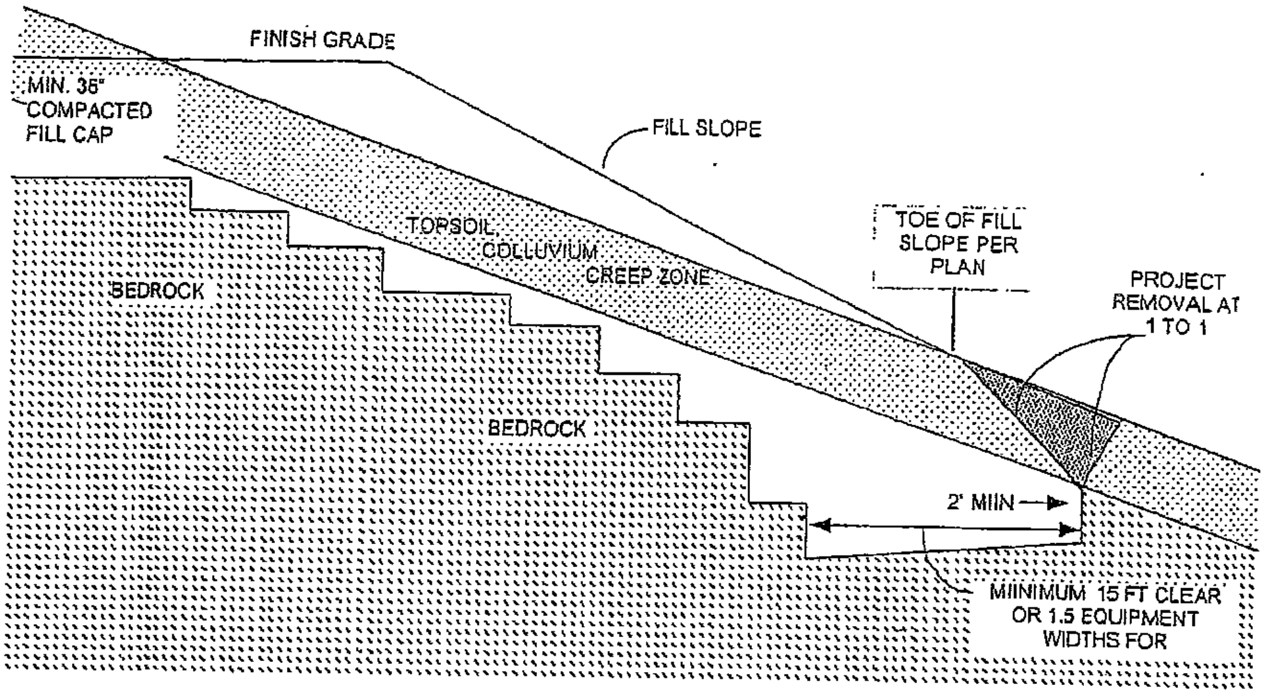
The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.



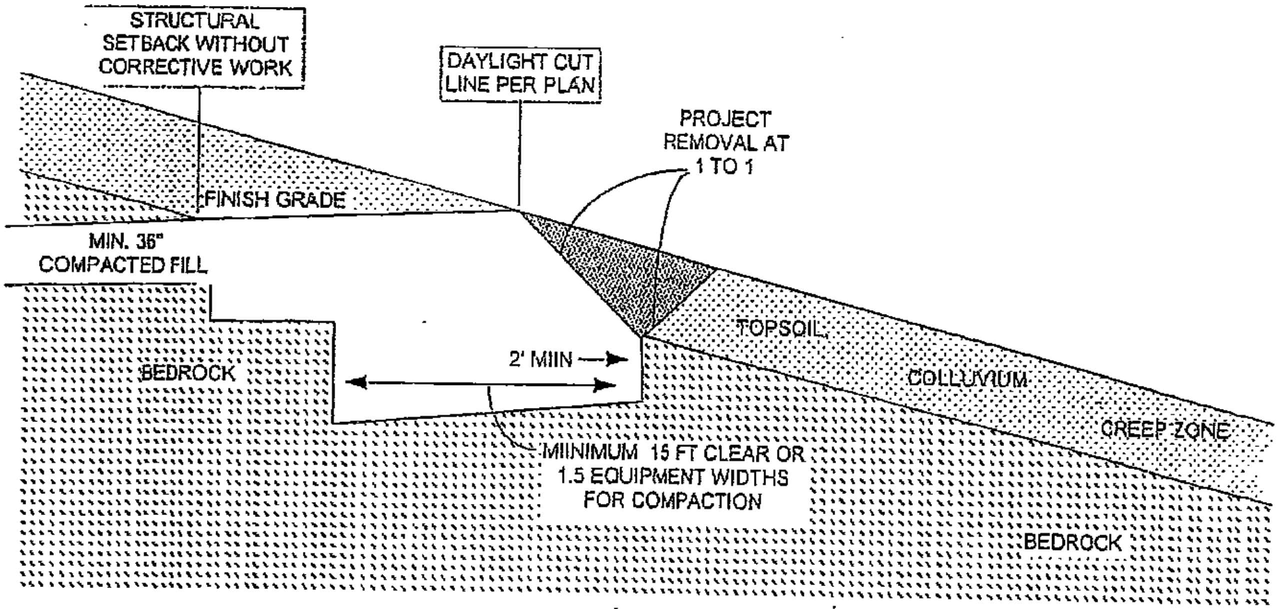


STANDARD GRADING GUIDELINES	TYPICAL CANYON CLEANOUT
GeoTek, Inc.	PLATE G - 1

TYPICAL FILL SLOPE OVER NATURAL DESCENDING SLOPE

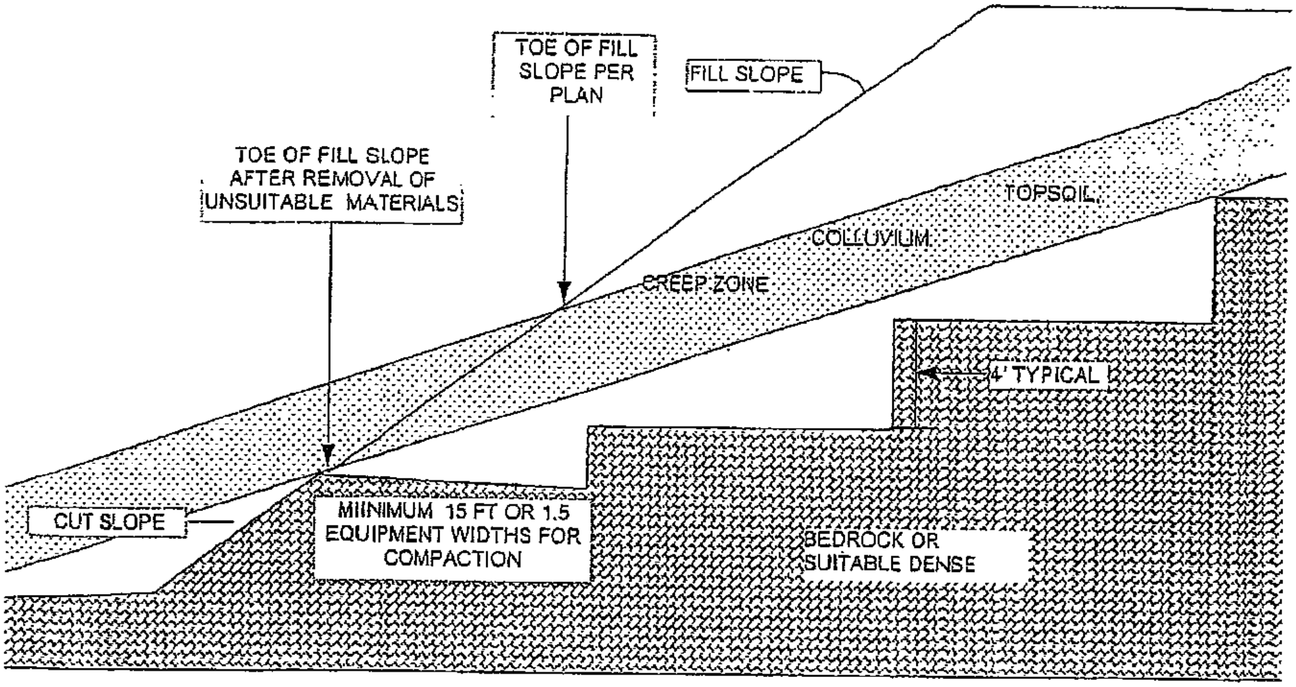


DAYLIGHT CUT AREA OVER NATURAL DESCENDING SLOPE

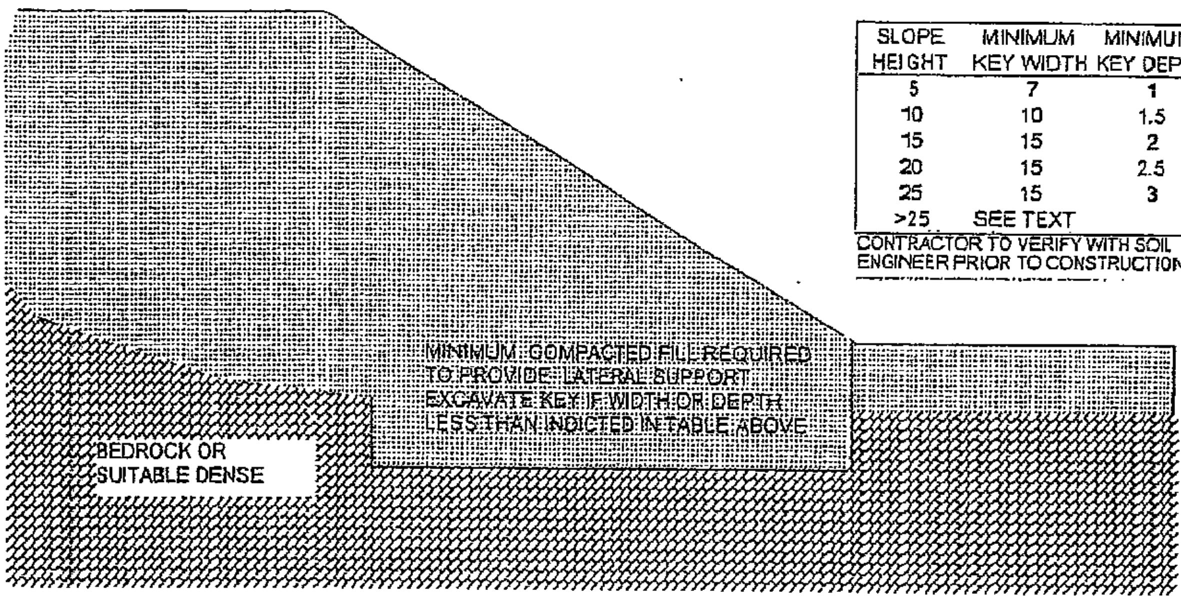


STANDARD GRADING GUIDELINES	TREATMENT ABOVE NATURAL SLOPES
GeoTek, Inc.	PLATE G - 2

TYPICAL FILL SLOPE OVER PROPOSED CUT SLOPE



TYPICAL FILL SLOPE

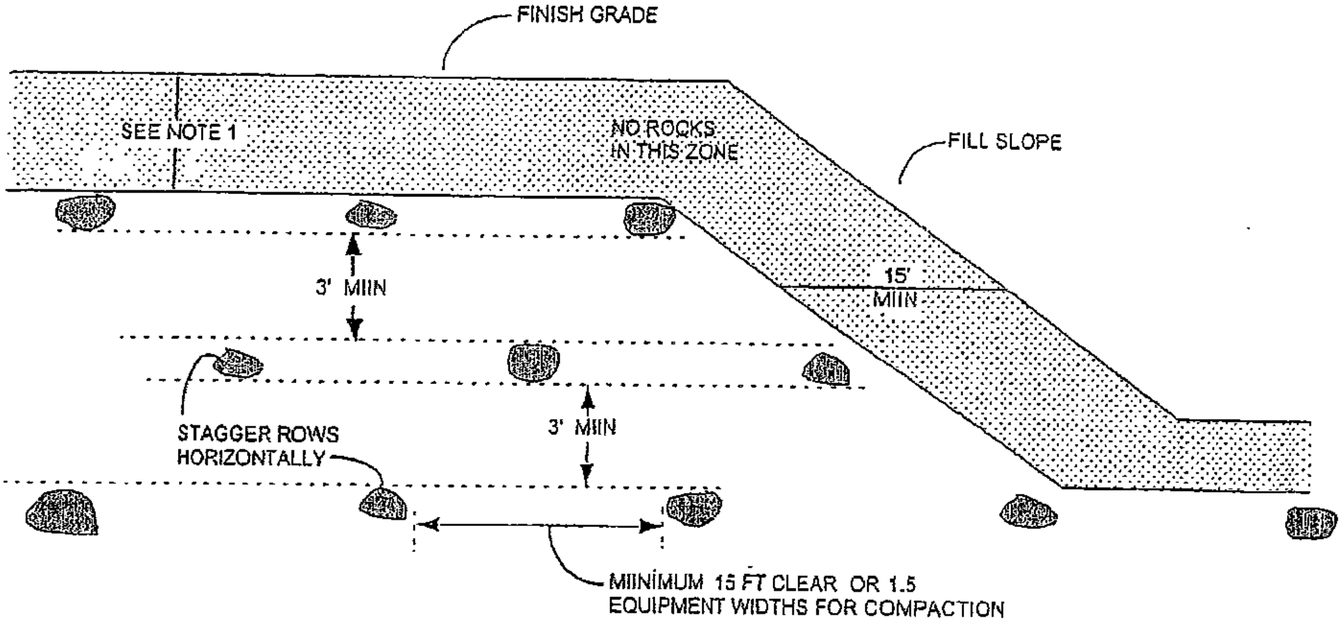


SLOPE HEIGHT	MINIMUM KEY WIDTH	MINIMUM KEY DEPTH
5	7	1
10	10	1.5
15	15	2
20	15	2.5
25	15	3
>25	SEE TEXT	

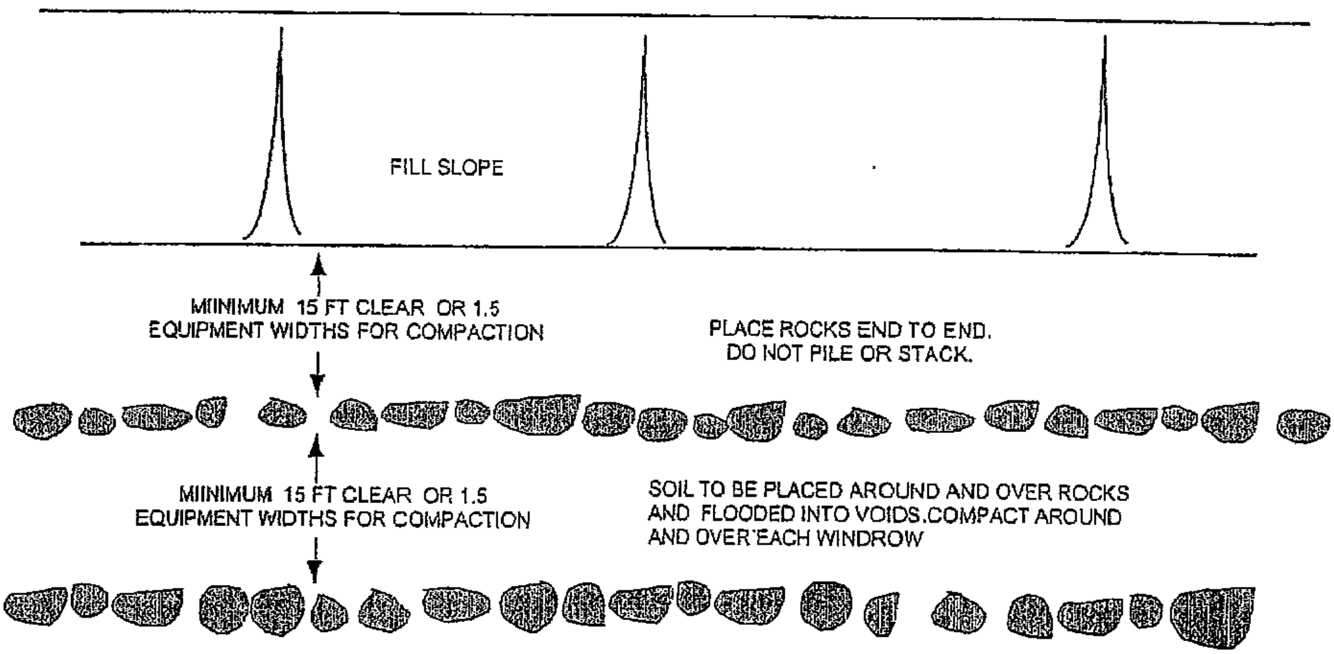
CONTRACTOR TO VERIFY WITH SOIL ENGINEER PRIOR TO CONSTRUCTION

STANDARD GRADING GUIDELINES	COMMON FILL SLOPE KEYS
GeoTek, Inc.	PLATE G - 3

CROSS SECTIONAL VIEW

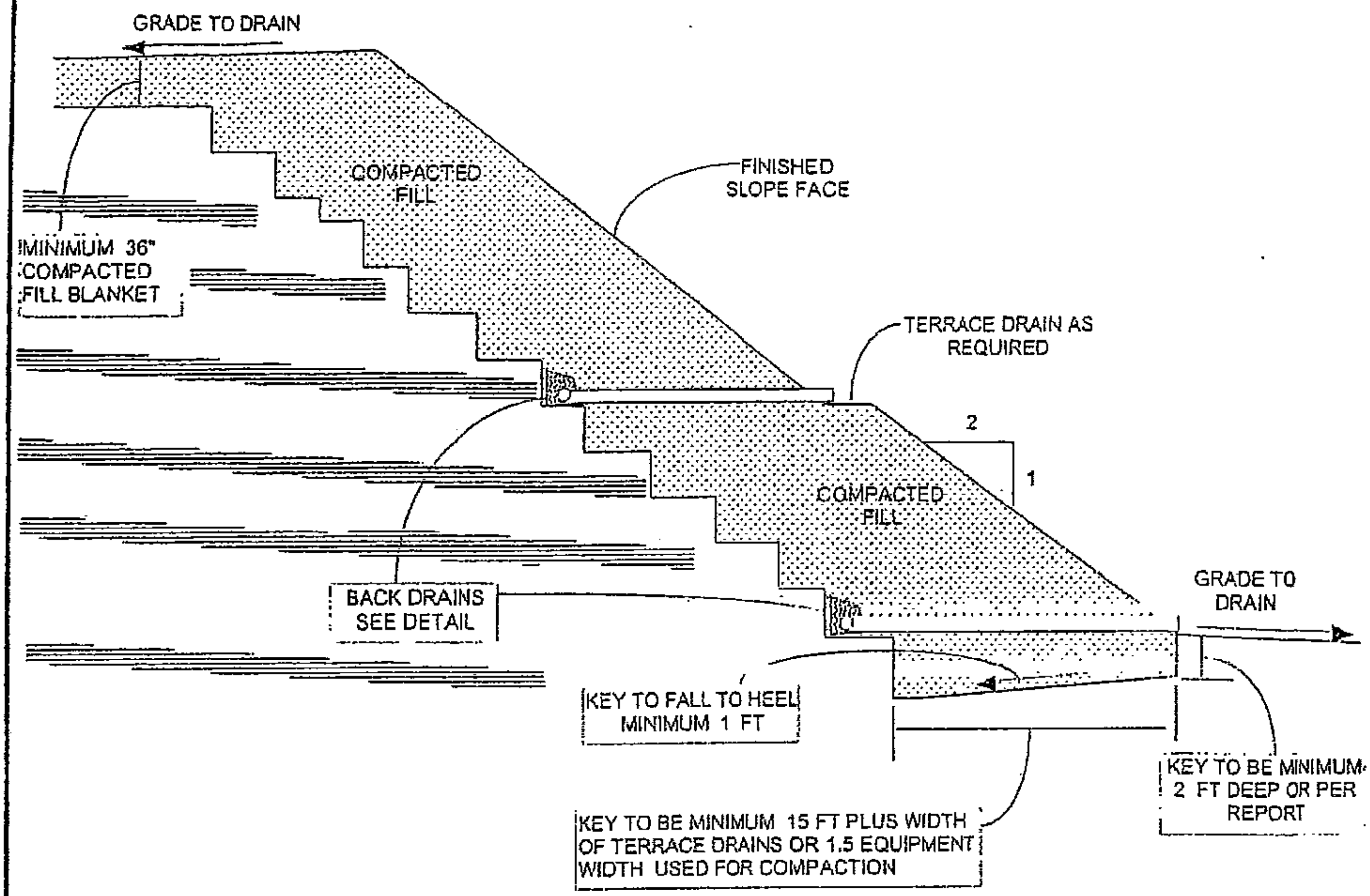


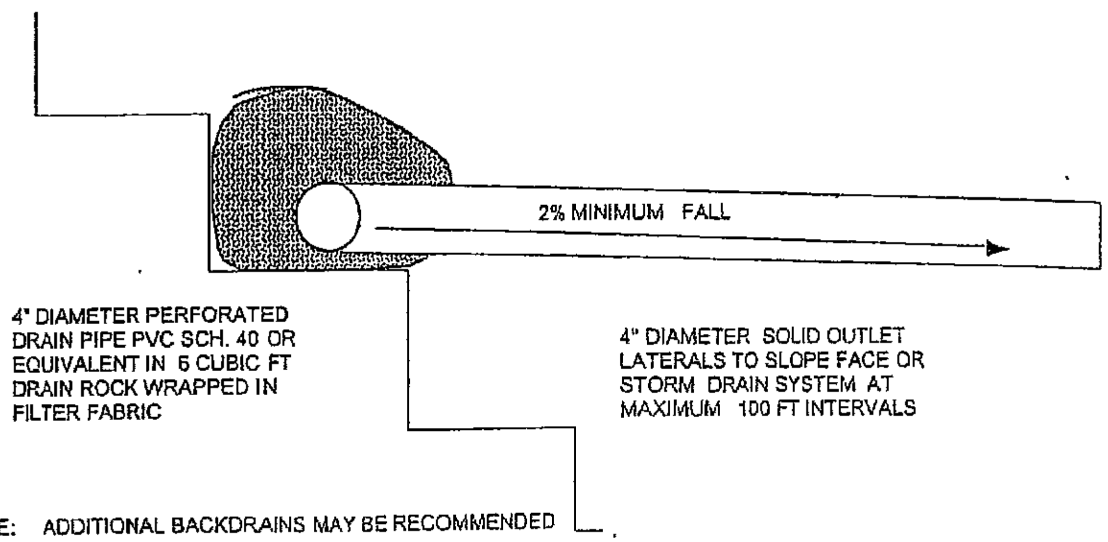
PLAN VEIW



NOTES:
1) MINIMUM SOIL FILL OVER WINDROWS SHOULD BE 7 FEET AND SUFFICIENT FOR FUTURE EXCAVATIONS (e.g. SWIMMIING POOLS) TO AVOID ROCKS.
2) MAXIMUM ROCK SIZE IN WINDROWS IS 4 FEET MINIMUM DIAMETER.
3) SOIL AROUND WINDROWS TO BE SANDY MATERIAL SUBJECT TO ACCEPTANCE BY SOIL ENGINEER
4) ALL SPACING AND CLEARANCES MUST BE SUFFICIENT TO ALLOW FOR PROPER COMPACTION.

STANDARD GRADING GUIDELINES	ROCK BURIAL DETAILS
GeoTek, Inc.	PLATE G - 4





NOTE: ADDITIONAL BACKDRAINS MAY BE RECOMMENDED

STANDARD GRADING GUIDELINES	BUTTRESS AND STABILIZATION SLOPES
GeoTek, Inc.	PLATE G - 5